

DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES

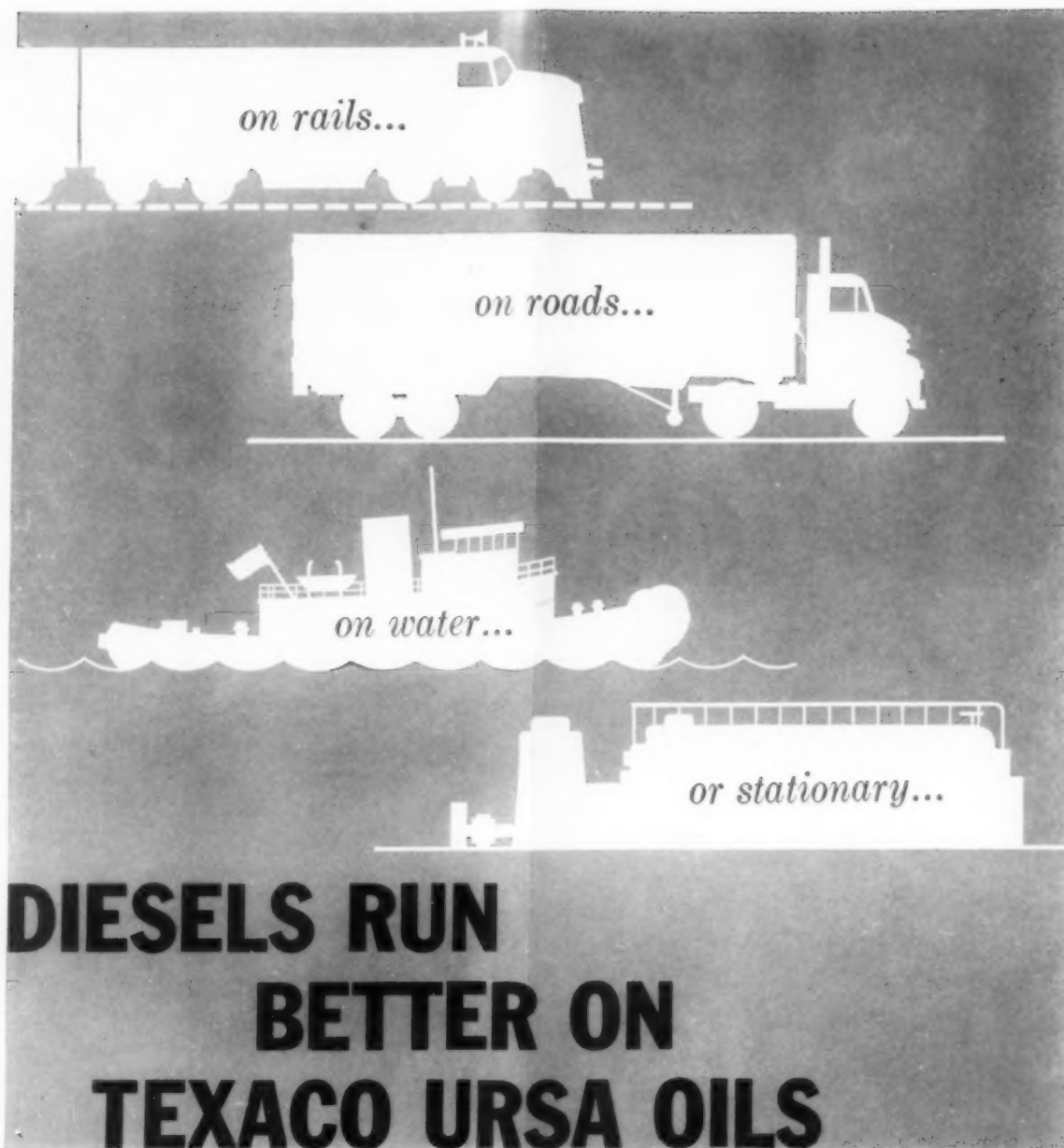
DIESEL AND GAS ENGINE PROGRESS



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OCTOBER, 1960

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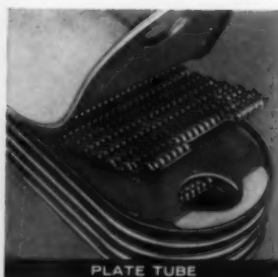
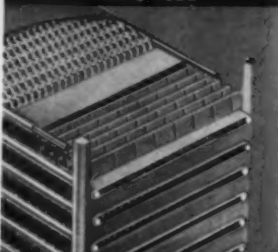
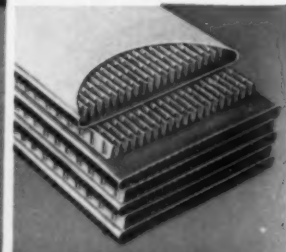


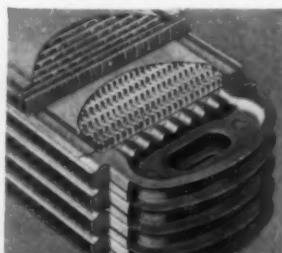
PLATE TUBE



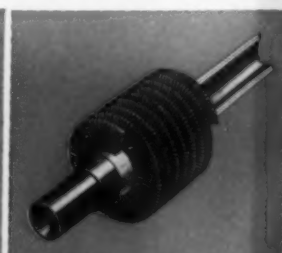
FORMED PLATE-FIN



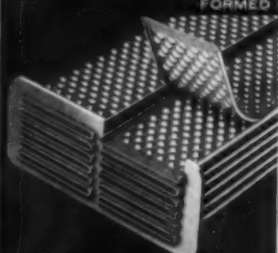
FLAT TUBE AND FIN



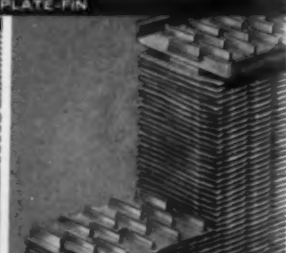
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DIESEL GAS ENGINE PROGRESS

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Editor and Publisher

DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES

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FRONT COVER ILLUSTRATION

Greco Excavating Co., Rosemont, Ill., repowered this Mack tractor with a new Caterpillar model 1673 truck engine. For story on the new engine see page 36.



EXCAVATOR-CRANES — The 21000 gives Koehring's Model 1205 the kind of dependable power needed for demanding shovel-crane service.



OFF-HIGHWAY TRUCKS — In Kenworth logging trucks, the 21000 diesel has outpulled competitive engines and done it on substantially less fuel.



SNOW BLOWERS — One of the advantages of the 16000's and 21000's on Sicard snow blowers is their unusually fast cold-weather starting.



CRUSHERS — The 16000 and 21000 generating sets have brushless generators, offer many electrical and mechanical advantages on all types of applications, such as powering this Lima-Austin-Western crushing plant.



new diesels prove themselves in all types of equipment

16000
230 HP

21000
(turbocharged)
340 HP

The amazing Allis-Chalmers 16000 and 21000 diesels are exceeding expectations wherever they are used.

Lowest fuel consumption — by far — The turbocharged 21000 uses as low as .355 lb of fuel per hp-hr — 8 to 27 percent less than any other engine in the field — by published claims! The saving is 1 to 2½ gal. in every 10. Buying fuel, hauling it or storing it, that represents important money.

Stamina to match — These diesels were actually operated at full load with half the rod and main bearings cut away...deliberately run hot and with only partial lubrication...operated with imbalances and intentionally weakened parts. Their stamina was tested far beyond toughest actual use. Reports from hundreds of engines in the field confirm the difference between these great diesels and others.

Power is THERE — at full throttle and at continuous rating. Torque is consistently high — to make any equipment perform at its best.

Superior starting — starts quickly and gets on the job — even at sub-freezing temperatures — without the use of starting aids.

Let us tell you more about these *modern* diesels with their cleaner, tougher, more serviceable design. Allis-Chalmers, Milwaukee 1, Wisconsin.

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Wherever in the world your heavy-duty diesels operate . . .



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- Shell Talona R Oil 40—anti-wear crankcase oil for diesel locomotives
- Shell Alvania Grease—multi-purpose industrial grease
- Shell Turbo Oils—for utility, industrial and marine turbines
- Shell Dromus Oils—soluble cutting oils for high-production metalworking
- Shell Macoma Oils—for extreme pressure industrial gear lubrication
- Shell Voluta Oils—for high-speed quenching with maximum stability



AN INTERESTING FACT!

Every Shell Branded Industrial Lubricant is named for a sea shell. Shown here is the *Rimula* exquisita.

Around the world, Shell Rimula Oil is available—under the same brand name and providing the same efficient lubrication that your domestic customers rely upon.

Rimula® Oil is a heavy-duty oil that provides the finest crankcase lubrication for today's super-charged diesels. It has proved more than a match for the greatly increased engine ratings, high temper-

atures and pressures encountered in modern diesel operation. Rimula Oil successfully resists every destructive force that tends to accelerate engine wear.

The next time your specifications call for a heavy-duty crankcase oil, we suggest you order Shell Rimula Oil. Write or call today for complete information.

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A CONTRACTOR'S PROFIT IS AS GOOD AS HIS MACHINERY

And an excavator is as good as its engine.

You cannot separate performance and profitability. This is why so many Original Equipment Manufacturers sell Caterpillar Diesels in their construction machinery—why so many contractors say, "Make mine a Cat."

The superior reputation of Caterpillar Engines is not new. It got a good start 30 years ago when the first Cat diesel was used in an excavator. Caterpillar had rigid quality control standards then. Today, they are far more strict. For example, each crankshaft undergoes 27 different quality control inspections. Engines must be built right, from the start, to be able to complement the performance of a machine. This is why Caterpillar technicians check samples of every heat at the mills where they are poured, again at Caterpillar's receiving dock, before the steel is released to be made into parts for Cat Engines.

Such standards as these at every step of engine manufacture help protect contractors' machinery investment. They also help protect the Original Equipment Manufacturer because the machine performs better; his dealer, because it substantially aids in building up a reputation that leads to repeat sales; and the contractor whose profitability depends upon both engine and machine performance.

Find out more about Caterpillar Engines for Original Equipment by writing for Form No. DN6041.

WHEN YOUR CUSTOMER SPECIFIES A CAT ENGINE... HE GETS:

- Maximum economy from the use of low-cost diesel fuel
- World-wide dealer service available at all times
- Higher output per unit of over-all operating cost

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Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

Auxiliary Gas Turbines becoming a prime power source for industry



Helmut Schelp, chief engineer, AiResearch Manufacturing Division of Arizona, Phoenix, surrounded by typical gas turbines now in production

ranging in size from 30 to 850 hp. Clockwise from the top: GTC 85-28 GTCP 105 • GTP 70-6 • GTP 30-1 • GTP 70-10 • GTU 85-2.

AiResearch Gas Turbine Engines, the most widely used power source for the starting, air conditioning, cooling and heating of jet aircraft, now are becoming a prime power source for industry.

Easier to maintain because of few moving parts, these lightweight gas turbine engines develop more horsepower per pound of weight and size than any other engine. Achieving their greatest efficiency

at maximum speeds, they run on almost any fuel and start immediately in any weather.

Present prime power applications of AiResearch gas turbines for industry: earthmoving equipment; small independent generator plants; marine use; helicopters and small conventional aircraft; emergency power plants; air conditioning, heating and refrigeration; atomic energy (closed cycle gas

turbine with atomic energy heat source).

First to design and develop a successful small gas turbine engine, Garrett is the world's largest manufacturer of lightweight turbomachinery — having delivered more than 200,000 units, including 9000 gas turbines of all types ranging from 30 to 850 hp. Through its AiResearch Manufacturing Divisions, The Garrett Corporation is now offering this experience to all industry.



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for every industrial job

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

Twin Disc Friction and Fluid PTO's — the world's most complete line

STANDARD FRICTION PTO



Easy-to-mount unit consisting of clutch PTO assembly with shaft and bearings in a rigid cast iron housing. Designed for manual operation on all internal combustion engines with standard SAE fly-wheel housings from No. 6 to No. 00. Triple-plate 14" to 21"; double-plate 11½" to 24"; single-plate 6½" to 24". Twenty models with horsepower capacities to 600 hp and torque capacities to 6730 lbs.-ft.

AIR-OPERATED PTO



A new series combining the convenience of Model PO Air Clutches with the time-tested dependability of Twin Disc Friction PTO's. Ideal for drilling rigs where the operator must work from a remote driller's platform. A touch on a control valve handle engages and disengages the clutch . . . provides "torque without effort." Normally requires only 90 psi air pressure. Capacities to 600 hp. Conversion kits available.

"LIMITED ATTENDANCE" FRICTION PTO



(Illustrated
less housing)

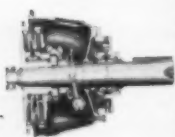
A modified version of the standard Twin Disc PTO. Features a new clutch engagement mechanism that virtually eliminates throw-out collar wear, ends daily greasing for good. In oilfield pumping jack service this PTO will quickly pay for itself in labor savings alone because it needs greasing only twice a year. Available in 10", 11", 14", and 18" sizes. Conversion kits for older PTO's also available.

FLUID PTO (Model HU)



Used on constant-speed, constant-torque drives where efficiency of 95% or better is desired. Consists of a fluid coupling combined with a cast bell housing, bearings and output shaft. In oilfield pumping installations, Model HU improves engine operation by reducing variation in engine rpm per stroke by as much as 50%. Also cuts engine vacuum variation for lower BMEP. Sizes: 14.5, 17.5 and 21.

NEW "HIGH-ENERGY, HIGH-SPEED" PTO



A recent Twin Disc development for engines developing 300 to 500 hp at speeds up to 3380 rpm. Designated Model 1BF-214P, it has a unique ventilated center plate that permits air flow to dissipate excess heat. An amazing ability to withstand high-energy loads makes this PTO well suited to applications where equipment is subject to heavy starting loads. Tapered roller bearing is continuously lubricated with oil. Improved throw-out collar design permits extending greasing periods up to six months.

DISCONNECTING FLUID PTO (Model HUD)



Disconnects power source from driven equipment to reduce impact shocks 70% or more. Eliminates "engine fighting" to assure balanced distribution on compounds. Life of chains, clutches and other running parts is almost doubled. Isolation of torsional vibrations and elimination of slow-speed lugging saves wear and tear on engine. Furnished with 21" or 27" double-circuit fluid couplings for engines with #0 and #00 housings in the 100 to 600 hp range.

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois



Osborne-McMillan Elevator Company
Minneapolis 15, Minnesota

Stuck Rings Plague Grain Elevator's Diesel Power Plant

**Cities Service DC-300 Oil Stops Ring Sticking . . .
Doubles Period Between Overhauls**

Minneapolis is a major grain terminal fed by the railroad from the Northwest plains area. This grain is stored, mixed and cleaned in the city's huge elevators. One of the largest of these elevators is the Shoreham owned by the Osborne-McMillan Elevator Company.

A company like Osborne-McMillan must be able to buy or sell grain, often within a matter of hours. If there's a power failure at the elevator, it might be necessary to pass up important opportunities. Even a short breakdown at a critical time could cost the company thousands of dollars.

The Shoreham Elevator is powered by two Fairbanks Morse diesels. One furnishes power through a direct drive to elevate grain and move boxcars as they are unloaded. The other diesel generates electric power throughout the elevator.

A constant source of trouble on both engines was sticky rings. Every three

months this had to be remedied. Also, the two diesels have to be torn down every year for overhaul. Since the switch to Cities Service DC-300 oil, ring problems have disappeared. Mr. Howard Radloff, operating engineer, states, "These engines are pretty old but they have been purring like kittens ever since we started using DC-300. We have extended the overhaul period to two years and I feel that could be extended again to three years without danger."

If you demand outstanding performance from your diesel engines, you should investigate the improvements that can be made with the use of a high quality lubricating oil such as DC-300. Oil consumption can be reduced while you cut operating expenses. For full information, call your nearest Cities Service office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, New York.



Howard Radloff, operating engineer discusses performance of diesels with Cities Service Lubrication Engineer. Cities Service DC-300 oil has been major factor in trouble-free performance.



The Shoreham can handle 3¼ million bushels of grain. This is one of the largest single units in Minneapolis and facilities must be available at a moment's notice.

CITIES  SERVICE
QUALITY PETROLEUM PRODUCTS



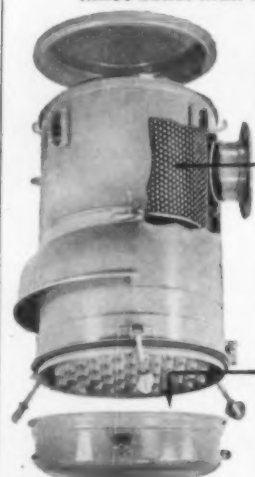
"We've found the answer to our dust problem... Donaclone Air Cleaners"

reports Ray Beaulieu,
Equipment Superintendent
for Lynn Sand & Stone
Co. of Swampscott, Mass.



"Donaclones cut our operating costs 3 ways"

Donaclones clean air 10 to 20 times better than oil bath types!



Only 2% of dust reaches Duralife paper filter!

Embossing and pleating provide maximum filtration area. Controlled porosity gives 99.9% dust removal.

98% of dust removed here!

Cluster of Donaclone tubes make up highly-efficient primary centrifugal cleaning stage. Dust is ejected into dust cup for easy servicing.

Paper filters filter best, but it takes efficient pre-cleaning to make them practical from the servicing viewpoint. Note above that Donaclone tubes remove 98% of the dust. Only 2% reaches the Duralife filter, greatly increasing service life.

Mr. Beaulieu supervises a rigid maintenance program for his fleet of trucks. He doesn't need to guess at Donaclone benefits... *he knows*. Here are the 3 savings he reports.

1. Extended engine life. "With Donaclones we can tell there will be a difference in engine life. This is revealed by our regular oil analysis program. We expect to get many more hours of life from our truck and mixer engines."

2. Cuts maintenance time. "It takes us from 3 to 5 minutes to clean a Donaclone as against an hour to clean oil bath cleaners. In terms of labor alone, the savings are appreciable."

3. Saves oil. "Our oil bath cleaners used one gallon of oil every change."

Lynn Sand & Stone Co. has installed Donaclones on nine pieces of equipment. The company expects to have 35 pieces of equipment changed over within a year.

Longer engine life will cut your operating costs. Leading equipment builders and contractors have switched to Donaclones because of proved air cleaning performance. There's a dealer near you. Tear off coupon and mail today.

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St. Paul 14, Minn.

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AND MAIL

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☐ Have distributor call

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SO RIGHT! SO SIMPLE! SO LOGICAL!

POSITIVE SHIFT CO-AX STARTING MOTORS



Use the AUTOLITE CO-AX on your farm, marine, construction equipment, trucks, cars, diesel and industrial engines. Check its many design advantages, its plus values.

MORE COMPACT. Shifting solenoid located inside pinion housing coaxially with clutch. No external elements to interfere with engine or accessories.

MORE ADAPTABLE. Rugged one-piece pinion housing designed so that a flat for terminal and switch can be machined at any point on circumference. Results: almost unlimited mounting positions; one motor can be adapted to several different engines.

MORE PROTECTION. Motor and solenoid are enclosed...no linkage or solenoid exposed to dirt, water, snow

or to other damaging foreign objects.

QUIETER SHIFT. Enclosed and direct acting mechanism provides quieter engagement and insures accurate timing of pinion engagement with switch closure.

LONGER USEFUL LIFE. The reduced engagement clash means less wear, greater length of service.

EASIER SERVICING. By simple removal of screws switch comes off and is replaceable as unit.

PERFORMANCE RANGE. Co-Ax motors for diesel and large gas engines are

conservatively rated on SAE standard and heavy duty battery curves as follows:

12 volt motors

2.4 hp, 28 lb. ft. stall ... to ...
3.6 hp, 44 lb. ft. stall

24 volt motors

2.8 hp, 35 lb. ft. stall ... to ...
6.5 hp, 78 lb. ft. stall

Smaller Co-Ax motors are also available with range of performance for automotive, agricultural and industrial engines. For additional information, write: Autolite, Toledo 1, Ohio.

AUTOLITE.

ELECTRICAL PRODUCTS DIVISION
Toledo 1, Ohio



Robertshaw CONTROLS

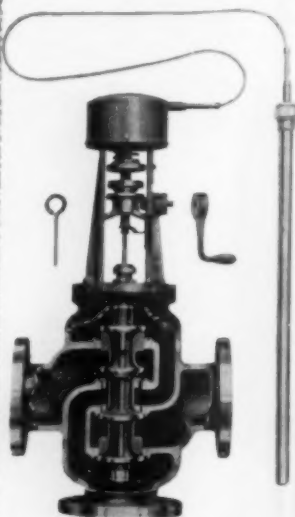
An Important Factor In Engine Safety, Performance, Durability

Designed for all types of internal combustion engines, Robertshaw controls help guarantee top efficiency with less maintenance . . . and at lower cost. Our one-source responsibility combines research and manufacturing, with field engineering assistance across the nation. When "everything's under control" . . . Robertshaw's well represented!



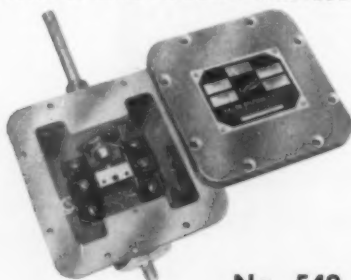
Solid-Front Gages

Now made by Robertshaw, the Acragage line features pressure, vacuum, compound and test gages in wide ranges. All have safety-first solid fronts, with full area blowout disc at the rear. Stainless steel movements and longer bourdon tubes for greater accuracy and durability. "Shockstop" pulsation protector available. **Catalog G**



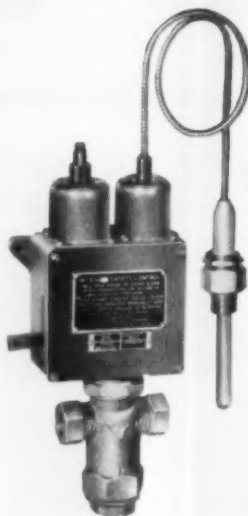
No. 1010 Temperature Regulator (Three-way valves)

For water or oil; controls flow of cooling water to maintain jacket water or lube oil at correct temperature. Automatic or manual-crank operation. Valve sizes 1/2" to 6". **Catalog H**



No. 542 Temperature/Pressure Explosion-Proof Switch

Sounds alarm, flashes warning light, or stops engine if oil pressure drops or cooling water temperature reaches danger point. UL-approved for Class I, Group D installations where atmospheres are hazardous. Integral bulb type. Fail-safe thermal element. **Catalog H**



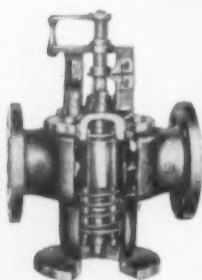
No. 530 Temperature/Pressure Shut-Down Unit

Fuel shut-off valve kills engines immediately if jacket water temperature exceeds safe limit, or lube oil pressure drops too low. Self-powered alarm optional. May be used to pilot larger pressure-operated valves. **Catalog H**



No. 98901-A Fuel Gas Valve

Diaphragm actuator stops engines by cutting off fuel supply and venting fuel system. Prevents damage due to low lube pressure, high jacket water temperature or overspeed. Used with No. 530. **Bulletin TP-126**



No. 1280-1281 Cooling Regulators

All-in-one control for lube oil or cooling water. Responds instantly to temperature changes; automatically operates to maintain exact temperature for best performance. Valve sizes 2" through 6". **Catalog H**

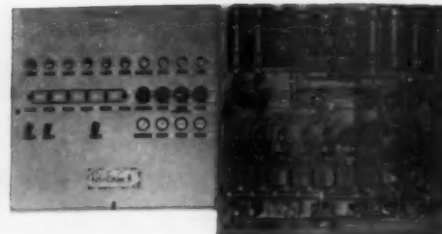


No. 1281

Factory set, completely tamper-proof; without manual positioner.

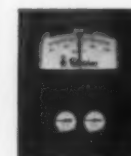
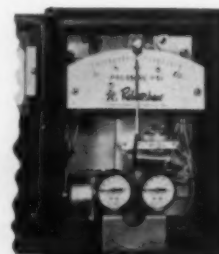
No. 1280
Manual positioner lead-sealed at factory; operable manually for emergency conditions.

Pneumatic Engine Control System



Designed specifically for pipeline requirements; adaptable to all internal combustion engine installations. All essential start/stop operations interlocked and controlled in proper sequence; prevents engine damage from malfunction or abnormal conditions. Completely auto-

matic; removes possibility of human error or oversight. Custom-engineered from standardized components. Backed by Robertshaw one-source responsibility and world-wide engineering organization. **Bulletin 760**



No. 1150 Indicating Pneumatic Controller (For Temperature or Pressure)

Designed as controller, transmitter, or receiver-controller, this unit features proportional action (0.5% to 200%) and fully compensated thermal system, with automatic reset optional. Easily installed and serviced. Temperature ranges from -30 to +450°F. Pressure ranges 0-20 psi., 3-15 psi., 0-150 psi. **Bulletin 757**

Robertshaw



ROBERTSHAW-FULTON CONTROLS COMPANY

FULTON SYLPHON DIVISION • KNOXVILLE 1, TENNESSEE

DIESEL AND GAS ENGINE PROGRESS

**CUMMINS V DIESELS
MORE COMPACT
MORE POWERFUL**



CUMMINS

ADDS A 700HP V12 DIESEL TO A GROWING LINE OF CONSTRUCTION ENGINES



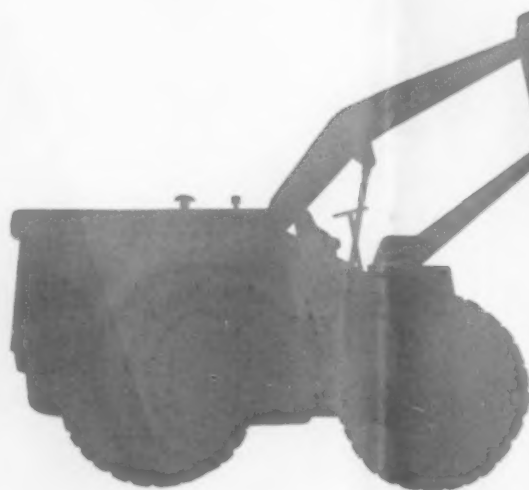
Newest of the V diesels from Cummins is the VT12-700. A real workhorse. It's big in horsepower, but not in size. Truly the most compact, most powerful highspeed engine on the market. And turbocharging permits full rated horsepower up to 10,000 feet.

Like the VT-700, the new, naturally aspirated V12-525 has features that will reduce operating costs. Both 12 cylinder engines have internal fuel and oil lines which eliminate damage to exposed tubing and connections. The revised PT fuel system automatically compensates for wear—needs only the simplest maintenance. A basic block improvement gives you a stronger, more durable engine.

The increased power of these new diesels is a natural advance from the famed VT-600 and NVH-450. For more than ten years these two models have had the field to themselves. Only Cummins could better their proven performance. How? By redesigning the cylinder area to permit higher horsepower at no increase in engine size or engine wear.

This big bore feature is also part of the V diesels at the lower end of the line . . . the V8-350 and the VT8-430. All new, all power from the pan up, they're the first 8 cylinder V diesels in this horsepower bracket built specially for construction equipment. Every kind of application, every operating condition was considered in their design. Service is easy because all accessories are mounted in the 90° angle between the cylinder banks.

Be assured of continued low operating costs with Genuine Cummins Parts and qualified service. For the complete profit story, see your Construction Equipment Dealer or Cummins Distributor.



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6-17-60

V8-350 HP

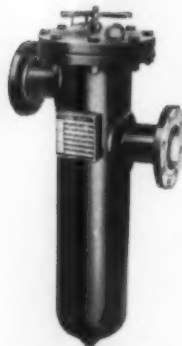
VT8-430 HP

NVH-450 HP

V12-525 HP

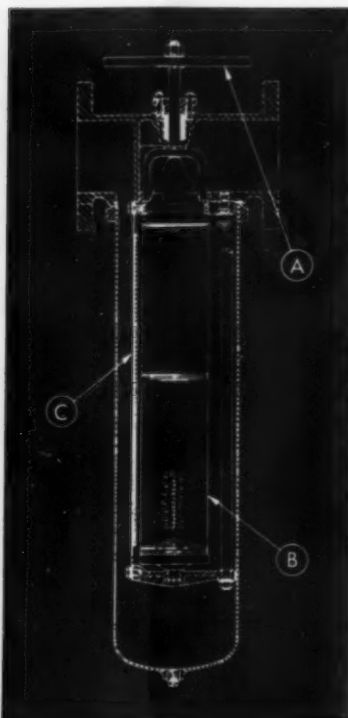
VT-600 HP

VT12-700 HP



PERMANENT, UNINTERRUPTED ENGINE FILTRATION

CLEANING the Purolator Series G-144J Metal Edge Filter is done by an occasional twist of hand wheel (A). This rotates Metal Edge Filter Element (B) so fixed knife blade (C) shears waste off the element as it rotates. Accumulated waste is periodically removed through plug at bottom of case. If service requirements warrant, filter element can be rotated continuously by motor drive.



Designed for filtering fuel or lube oil, Purolator Series G-144J Metal Edge Filter will make your engine last longer.

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filter element...keeps it working at top efficiency. There's no need to cut off the engine, or to interrupt the flow of oil.

This filter can be installed on either the suction or the pressure side of the pump and includes a relief valve. Degree of filtration ranges from 25 to 500 microns to suit your fluid requirements. For

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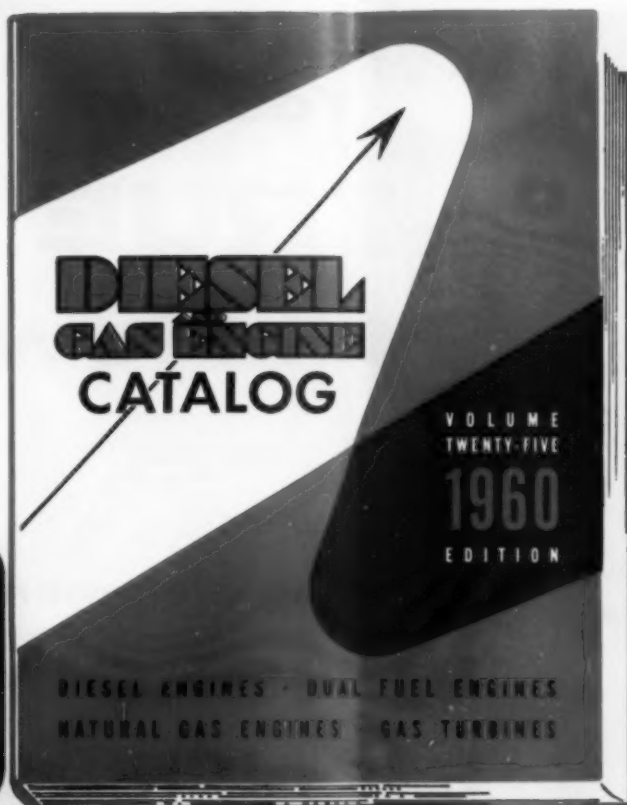
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3. **TRANSMISSIONS** — The latest information on torque converters, fluid drives, and other modern means of transmitting power are fully described and illustrated in this section.
4. **ACCESSORY EQUIPMENT** — Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.
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New Muffler Finish

A new, super finish developed by Alexander-Tagg Industries, Inc., is said to provide greater resistance to rust, chipping and pitting on their line of all-welded steel, heavy duty mufflers. In addition, the finish is said to improve the appearance of the ATI mufflers which meet or exceed engine manufac-

turers' requirements as to back pressure to give maximum horsepower, maximum operating efficiency and quiet operation—well under the 125 Sone noise level standards established by the American Trucking Association and Automotive Manufacturers' Association. For complete information, write Alexander-Tagg Industries, Inc., Hatboro, Pa.

ITS NEW

Allied Sales Director

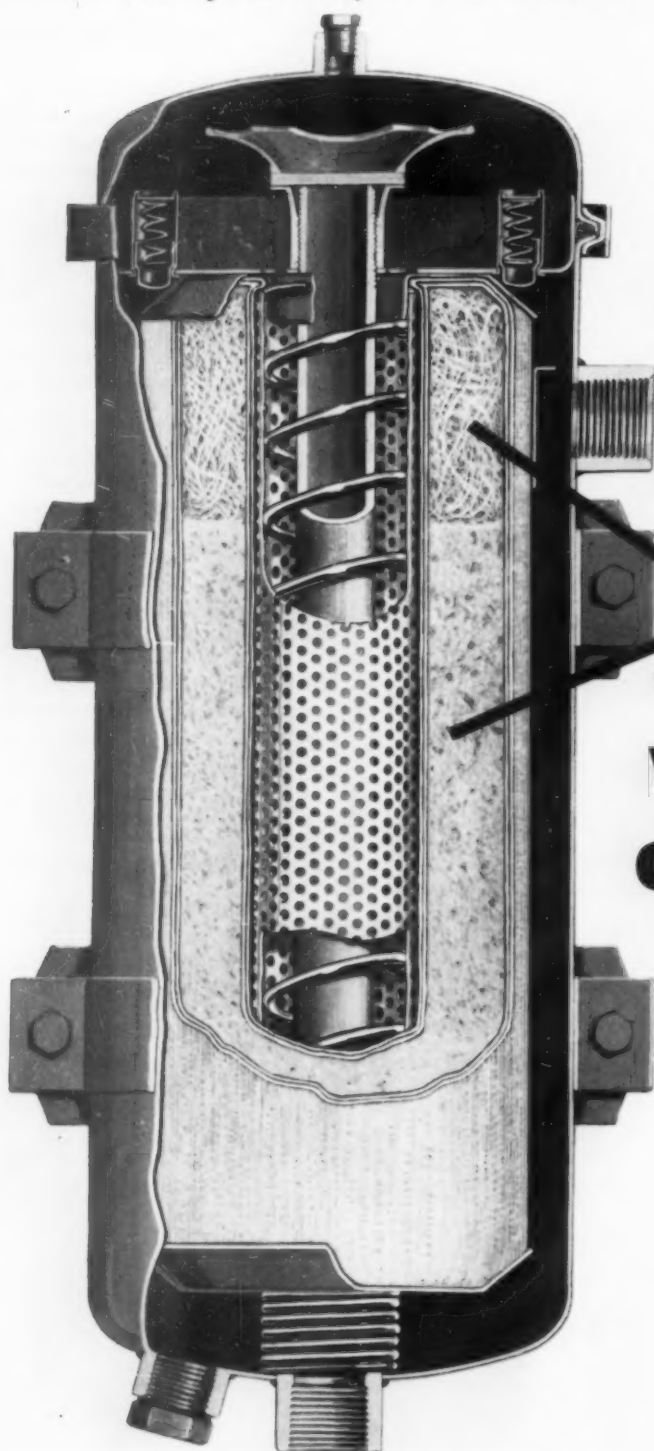
Fredric R. Cahn has been elected director of sales for Allied Metal Hose Co., Long Island City, N.Y., manufacturer of flexible metallic hose, tubing, and pipe connectors. Mr. Cahn's promotion to this newly-created post is part of the company's expansion program, started at the beginning of the year. The widened activities are designed to improve both product and customer service and to stress the advantages of engineered flexible pipe connector applications in many industries. Since joining Allied in 1950, Mr. Cahn has held a number of executive positions, including applications engineer. His most recent post was sales manager. As director of sales, he will coordinate Allied's accelerated program of advertising, promotion, public relations, and sales-engineering.

Colored Power Cable

Dual advantages of high visibility for safety and ruggedness for utility have been built into power cable now being manufactured by a West Coast firm. Constructed with an outer cover of yellow neoprene, the new cable will be particularly useful in plants and on many other indoor and outdoor projects where power equipment is used. The color is a built-in signal for safety, preventing the hazard of tripping over unseen wires. And in out-of-doors work, its visibility prevents it from being run over inadvertently by heavy construction equipment. When used as a permanent wiring, the yellow-jacketed cable makes it easy to trace or designate a specific circuit. Black neoprene-jacketed wiring has been in use out of doors in some areas of the United States for as long as 25 years without any evidence of deterioration. The new yellow cable has the same properties, including excellent weathering properties and resistance to abrasion and attack by ozone. The yellow cable is unique in that the tradename is molded into the wire at two-foot intervals making it easy to measure quickly the desired amount of wiring. Other information including the type, size, number of conductors and voltage rating is also permanently molded, not inked, on the outer cover of the cable. If a purchaser desires, his company name can be molded in as well. *Broncolor* cable is designed for 300 or 600 volts (depending on construction) and for loads up to 250 amperes, and is available in two-, three-, or four-conductor sizes. Yellow is carried in stock in various sizes; production-run quantities of other colors, including control cables Types W and G, can also be purchased from the manufacturer. The cable is manufactured by Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 58, Calif.

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Winslow Engineering & Manufacturing Company

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Export Division: Oceanic Export, San Francisco
European Plant: Epernay, France

WRITE FOR LITERATURE

New Gulf Lube Oil

A new versatile, high detergency crankcase lubricant formulated for use in diesel engines under most operating conditions has been developed by Gulf Oil Corp. It is now available throughout the Gulf marketing territory. The new oil formulation will be known as Gulf-lube motor oil H.D., the tradename previously used for one of the products which it supplants. The introduction of the new oil follows the trend toward simplifying lubrication through development of new products with broader application. It incorporates the individual advantages of three oils formerly marketed by Gulf. The new motor oil is formulated from specially-selected paraffinic stock, which, according to Gulf engineers, has high oxidation resistance, assuring stability even at high operating temperatures. The oil's heavy-duty characteristics are supplemented by a new additive selected for its effectiveness in performing a dual function: (1) The prevention of sludge formation due to low-temperature "stop and go" driving, and (2) Minimizing of engine deposits caused by heavy-load, high-temperature operations. The company reports that Gulf-lube Motor Oil H.D., can be recommended for all applications formerly filled by Gulf-lube Motor Oil X.H.D., Traffic Motor Oil S-1, and the previous brand of Gulf-lube Motor Oil H.D. It is recommended for A.P.I. Service Classifications ML, MM, MS, DG and DM. The oil's heavy-duty, many-purpose characteristics make it effective for diesel engines in fleets of all kinds ranging from taxicabs to buses and trucks. The new product exceeds Military Specification Mil-L-2104A. It is a Supplement 1 oil available in S.A.E. viscosity grades 10W, 20/20W, 30, 40, and 50. **ITS NEW**

Solar PR, Ad Director

Robin Schmidt has been promoted to director of public relations and advertising for Solar Aircraft Co. Mr. Schmidt joined Solar in the public relations and advertising division in 1957. He was a public relations man with Pacific Finance Corporation in Los Angeles, and a newspaper reporter with The Los Angeles Times and other newspapers.

Plan Sales Agreement

Boeing Airplane Co.'s Industrial Products Division and Mitsubishi Heavy Industries, Reorganized Ltd., have signed a letter of intent covering agreements on manufacture, sales and service of Boeing gas turbines in Japan and the Far East. The letter covers plans of the Boeing division and Mitsubishi Heavy Industries to negotiate agreements covering three specific items. These are maintenance, repair and overhaul of Boeing

502 turbines in Japan; Mitsubishi's function as a possible subcontractor for turbine parts, and manufacturing and sale of complete Boeing turbines by Mitsubishi. Boeing's 502 turbine engine series includes powerplants in the 210 to 360 shaft horsepower range. Formal negotiation leading to agreements are expected to begin between the Boeing division and Mitsubishi by year's end.

Exide Names Clark

Robert L. Clark, former railway sales engineer in the Chicago district for Exide Industrial Division of The Electric Storage Battery Co., has been transferred to the division's national headquarters and was named railway market manager. He succeeds Lowell K. Lembke who recently was moved to St.

Louis to become manager of Exide's south-central region. In his new position, Clark coordinates and promotes national sales and service efforts for Exide batteries and charging equipment used for starting diesel locomotives, for lighting and air-conditioning of passenger cars, and for powering signal and other electronic and communications equipment on railroads.

17 POWER-FULL

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WEST COAST



CANADA

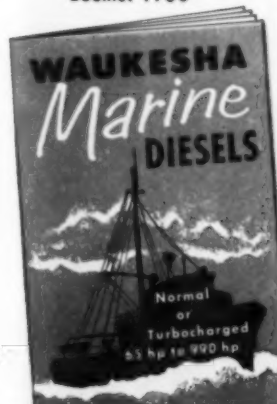


NORTH ATLANTIC



GULF COAST

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Booklet 1760



Engine	Type	Cyls.	Bore & Str.	Displ.	24-Hr. Max. Rating
RELIANCE	Normal	12	8 1/2 x 8 1/2	5788	725 hp @ 1215 rpm
	Turbo	12	8 1/2 x 8 1/2	5788	990 hp @ 1215 rpm
DEFENDER	Normal	6	8 1/2 x 8 1/2	2894	335 hp @ 1215 rpm
	Turbo	6	8 1/2 x 8 1/2	2894	510 hp @ 1215 rpm
WANDERER	Normal	6	7 x 8 1/4	1905	240 hp @ 1215 rpm
	Turbo	6	7 x 8 1/4	1905	315 hp @ 1215 rpm
RESOLUTE	Normal	6	6 1/4 x 6 1/2	1197	195 hp @ 1600 rpm
	Turbo	6	6 1/4 x 6 1/2	1197	290 hp @ 1600 rpm
VIGILANT	Normal	6	5 1/4 x 6	779	130 hp @ 1800 rpm
	Turbo	6	5 1/4 x 6	779	195 hp @ 1800 rpm
CUTWATER	Normal	6	4 1/4 x 5	426	100 hp @ 2000 rpm
	Turbo	6	4 1/4 x 5	426	120 hp @ 2000 rpm
NAVIGATOR	Normal	6	4 x 4	302	65 hp @ 2000 rpm
	Turbo	6	4 x 4	302	85 hp @ 2000 rpm

CRANKCASES Waukesha special alloy cast iron. Heavy main bearing bridges and thick oil pan mounting flanges and end walls—designed for maximum rigidity.

CYLINDER HEADS Valve-in-head high compression type. Clean-burning, controlled turbulence, patented spherical combustion chambers. Injection nozzles and combustion chambers removable from the outside.

CYLINDERS Removable wet sleeves of Waukesha special heat-resistant alloy iron in all engines except Cutwater and Navigator. Cutwater and Navigator have dry sleeves.

PISTONS Heavy-duty aluminum alloy with wedge-type compression rings. Oil control rings are parallel-side type. Pistons ribbed for extra strength; designed for even heat expansion.

CONNECTING RODS Forged steel, rifle-drilled for pressure oiling to pin bearings. Both ends precision-machined on parallel centers to Waukesha Quality Control standards. Pistons and pins assembled in matched sets.

CRANKSHAFTS Forged steel shafts are machined and precision ground in Waukesha's shops to rigid Quality Control standards. All crankshafts carefully balanced, with large diameter journals, for smooth power flow through entire power train to shaft and propeller.

MAIN and ROD BEARINGS Precision-type replaceable steel-backed bearing shells held by deep-section caps. Unusually large total bearing areas.

EXHAUST MANIFOLDS Water-cooled exhaust manifolds on all models.

GOVERNORS Automatically lubricated, mounted on injection pumps in all models, except the Defender and Reliance which use governors driven from the engine gear train.

FUEL SYSTEMS All Waukesha Marine Diesels equipped with Bosch injection pumps (except the Navigator which has the Roosa-Master pump), drawn steel injection lines and pintle-type injection nozzles. Combustion chamber assemblies removable from the outside.

LUBRICATING SYSTEMS Positive pressure gear-driven lubricating pumps and scavenger pumps. Pressure relief valves. Oil filters and coolers.

COOLING SYSTEMS Centrifugal pump cooling. Directed circulation, and coolant passage design eliminate hot spots and promote even heat control. Expansion tanks for all models. Engines engineered for either heat exchanger or keel cooling.

STARTING SYSTEMS Electric systems with starting motors, generators and regulators, available for all models. Air or hydraulic starting available.

POWER TAKE-OFF Front end power take-off for driving hydraulic pumps, auxiliary generators or air compressors, raw water and bilge pumps, winches and other marine accessories (except on Navigator Series).

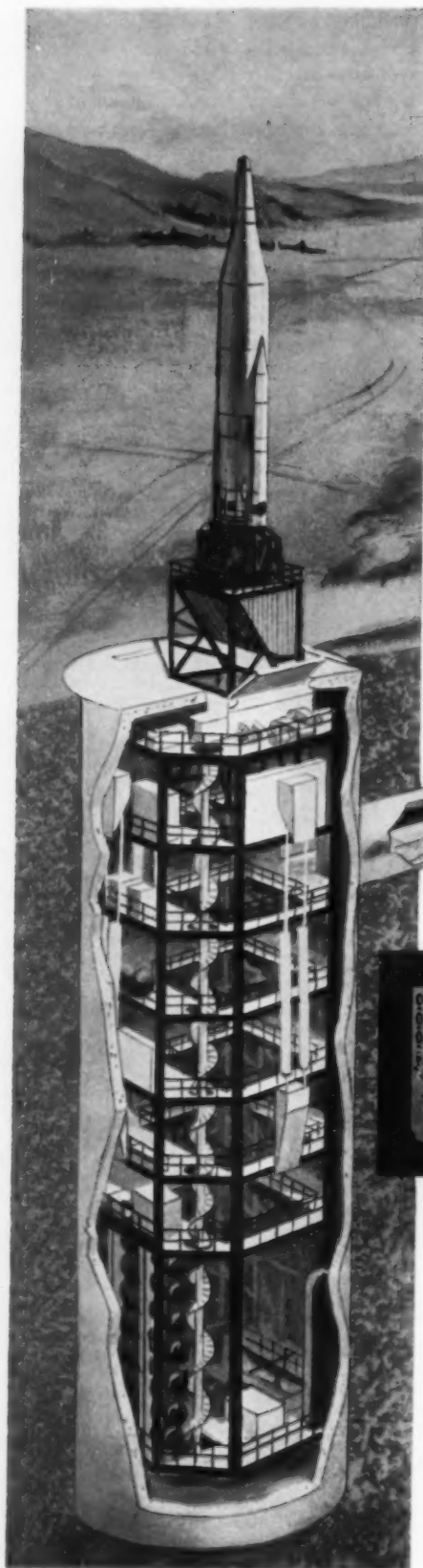
REVERSE and REDUCTION GEARS Reverse and reduction gears in size and ratios to match all Waukesha marine engines and the service requirements.

CONTROLS and INSTRUMENTS Oil Pressure and water temperature gauges, starter switches, safety devices, instrument panels, and tachometer drives. Visible and audible alarms or facilities therefor, as specified.

OTHER ACCESSORIES and EQUIPMENT are available for special services.

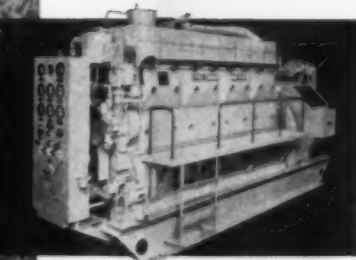
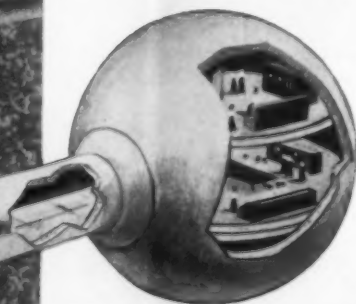
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Factories: Waukesha, Wisconsin and Clinton, Iowa

498



WHITE SUPERIOR ENGINES selected for ATLAS launching sites!

At USAF Atlas launching sites throughout the United States, prime and standby power will be supplied by White Superior engines! The Army Corps of Engineers, Kansas City, Missouri, has purchased 149 eight-cylinder supercharged Model 40 Superiors, each driving a 500 KW generator. These engine-generator sets will produce precise frequency for operation of computers and other electronic equipment. Six of the 13 planned Atlas ICBM squadrons will feature underground silo-type launching sites. Here an additional task for the Superiors will be powering elevator machinery to lift the 120-ton ICBM's to ground level, after they have been fueled and checked out down under.



*White
Diesel*



WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

The contract for 149 Superiors highlights a growing and impressive list of Superior-powered U.S. defense installations. Included are the "Texas Towers," portions of "DEW" line and "SAGE" project, Eglin Gulf Test Range and other missile tracking ranges, and numerous launching sites for other types of missiles. Acceptance of Superior engines for these assignments is convincing evidence of their rugged dependability, trouble-free performance and economical fuel consumption. Superior engines—215 to 2150 HP or 150 to 1500 KW—will also meet your exact power requirements, including automatic, unattended or remote controlled operation. Write for complete information today!

*USAF artist's conception of Atlas underground
silo for launching missiles*

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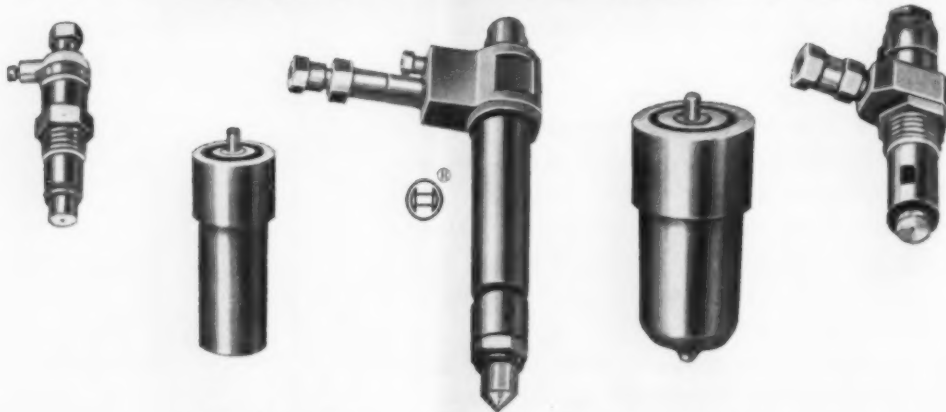
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WATERFLOOD PROJECT "BIG SQUIRT"

Revisiting Wilmington Oil Fields We Find Subsidence Nearly Halted and Oil Production Boosted 20 Percent: Here Is a Current Progress Report and a Look at Pier E Injection Plant with Eight Gas Engine Pumping Units

By JAMES JOSEPH

A PETROLEUM engineer enthusiastically stated, "Subsidence—land sinkage—has definitely been halted across 800 acres . . . more than 11 percent of the field," as he swept his hand across a map of the 6800-acre Wilmington, Calif. oil field, the nation's second largest producer, one of the world's richest (oil yield since 1936: 830 million barrels) . . . and the most subsidence plagued. Halting subsidence across those 800 acres, slowing it over an additional 1100 acres—and boosting oil production 20 percent—is Project "Big Squirrt".

Project "Big Squirrt" is one of the world's most ambitious waterflood programs. Its aim: both to halt subsidence thru re-pressuring and to spur secondary oil recovery. "Big Squirrt" is powered by a phalanx of pump engines (totalling nearly 10,000 hp, most of them natural gas fueled) which are daily re-pressuring the deep underlying stratas with more than 435,000 barrels of treated, nearly oxygen-free salt water, injected thru some 120 high pressure wells. A year ago (see DIESEL AND GAS ENGINE PROGRESS for Sept. 1959) engineers hopefully predicted that subsidence might be halted by their gargantuan waterflood program. Today, hope has become reality—in an area which, since 1938, has in places sunk fully 26 feet and, were it not for extensive diking, would today be inundated by the closeby Pacific Ocean.

On-the-line in what has become a herculean effort to halt subsidence threatening the field's 2846 producing wells, reserves estimated to run as high as 1.3 billion barrels and a dozen industrial plants employing 7500 workers are some 8 operative water-injection plants—vortex of Project "Big Squirrt".

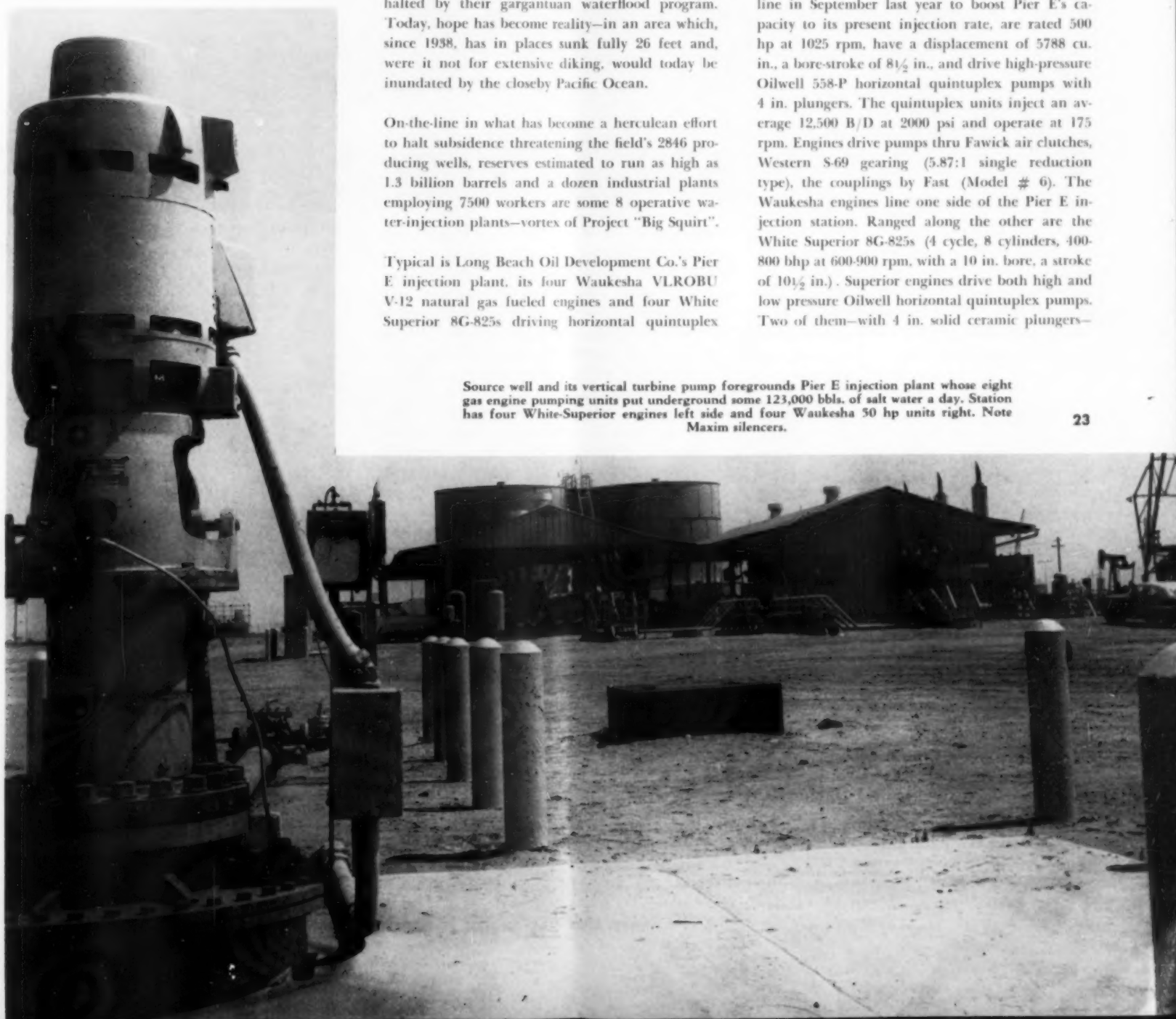
Typical is Long Beach Oil Development Co.'s Pier E injection plant, its four Waukesha VLROBU V-12 natural gas fueled engines and four White Superior 8G-825s driving horizontal quintuplex

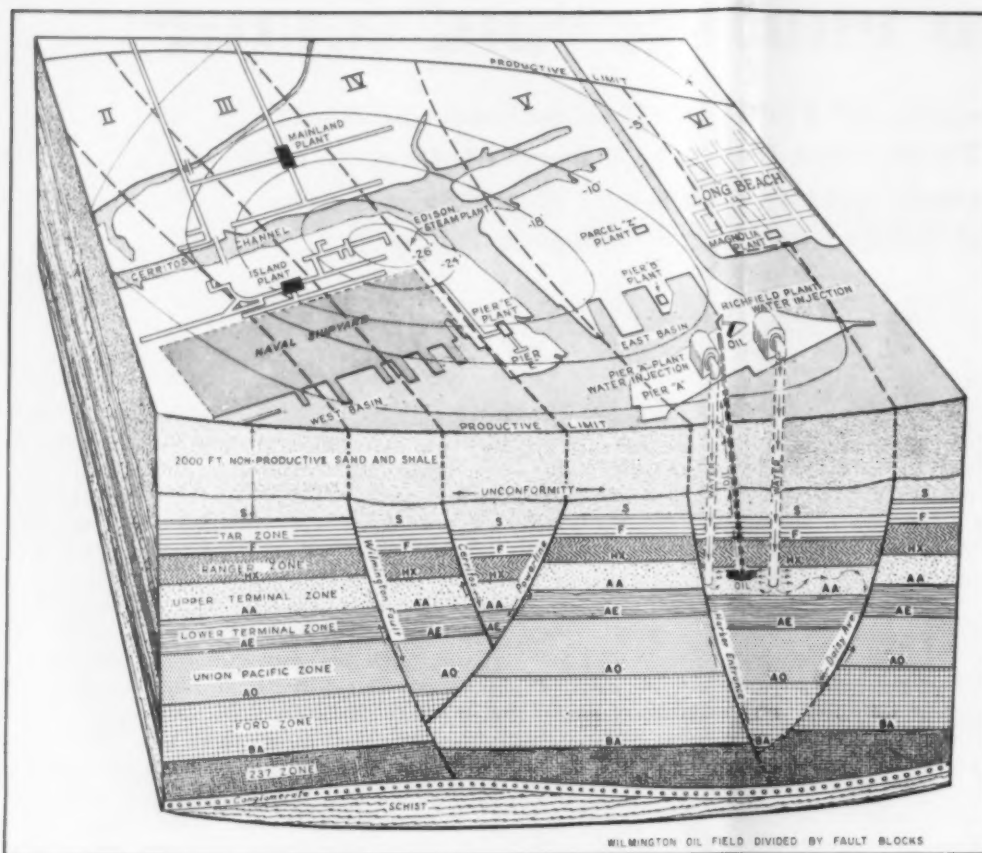
plunger pumps which daily inject 123,000 B/D of salt water underground via 17 wells. The Pier E plant (second largest of Project "Big Squirrt") was expanded by 50,000 B/D injection capacity last year to its present 123,000 B/D rate, tho maximum injection capacity is pegged at 165,300 B/D.

Like seven others of the 8 existing water-injection stations, the Pier E plant is owned by the City of Long Beach, and operated by its oil contractor, the Long Beach Oil Development Co. (LBOD). The Waukesha VLROBU V-12s, which went on the line in September last year to boost Pier E's capacity to its present injection rate, are rated 500 hp at 1025 rpm, have a displacement of 5788 cu. in., a bore-stroke of 8½ in., and drive high-pressure Oilwell 558-P horizontal quintuplex pumps with 4 in. plungers. The quintuplex units inject an average 12,500 B/D at 2000 psi and operate at 175 rpm. Engines drive pumps thru Fawick air clutches, Western S-69 gearing (5.87:1 single reduction type), the couplings by Fast (Model # 6). The Waukesha engines line one side of the Pier E injection station. Ranged along the other are the White Superior 8G-825s (4 cycle, 8 cylinders, 400-800 bhp at 600-900 rpm, with a 10 in. bore, a stroke of 10½ in.). Superior engines drive both high and low pressure Oilwell horizontal quintuplex pumps. Two of them—with 4 in. solid ceramic plungers—

Source well and its vertical turbine pump foregrounds Pier E injection plant whose eight gas engine pumping units put underground some 123,000 bbls. of salt water a day. Station has four White-Superior engines left side and four Waukesha 50 hp units right. Note Maxim silencers.

23





Drawing illustrates lay of fault blocks beneath Wilmington field . . . and locale of various injection stations, including Pier E. Note how injection stations ring vortex of sinkage, where land has slipped average 26 ft.

Head-on shot of one of the four Waukesha 12-cylinder V-type gas engines with its Western single reduction gear in background. At lower right on engine can be seen Ren oil level control. Engines are equipped with Bendix-Scintilla ignition system, Ensign carburetors and Oildex ventilating units.

wharf structures to relieve stress. (Harbor Department Report 4/2/57)

The most practical method of restoring pressures to subsurface areas is by injection of water under pressure. A pilot study of water injection was undertaken by the City of Long Beach in June of 1953. Since that time the number of wells has been increased from 2 to 120. The daily rate of injection has been steadily increased to a rate of 435,000 barrels of water per day. Note the following water flooding schedule:

Date	Injection Wells in Operation	Rate of Injection (B/D)
April 1, 1959	37	204,500
July 1, 1959	50	211,809
January 1, 1960	120	435,000
Ultimate Estimate	268	1,089,000 (Approx)

Results: within the past year, subsidence has actually been halted over a significant acreage . . . and slowed thruout much of the remaining area of the field. Moreover, in the process of halting subsidence over fully 11 percent of the giant field, waterflood has actually stepped up oil recovery—boosting production by some 20 per cent. Says one engineer, "the project may well pay for itself. One big opera-

inject 8000 to 12,500 B/D of water. The other two—with 5½ in. plungers—have capacity to inject 16,000/23,600 B/D.

Some idea of water injection's cost (\$30-million has already been pegged for the field-wide project) comes when you analyze so typical a big injection station as Pier E's. Here are the facts including the original plant of 73,000 B/D completed in Oct., 1958 and the expansion providing an additional 50,000 B/D completed in Sept. 1959:

INVESTMENT

ITEM	ORIGINAL	EXPANSION (EST.)	TOTAL
Building and foundations	\$ 34,986	\$ 15,648	\$ 50,634
Pumps and motors	244,033	236,267	480,300
Storage tanks	46,848		46,848
Plant piping	71,516	50,802	122,318
Fencing	12,771	18,759	31,530
Electrical system	15,884	1,409	17,293
Source wells	41,384		41,384
Distribution system	34,616	1,658	36,274
	\$522,038	\$324,543	\$846,581

TYPE OF PUMPS	MAKE	PRESSURES	CAPACITY (Max)
1 Horizontal Quintuplex Plunger	Oilwell	2000 psig	12,500 B/D
5 Horizontal Quintuplex Plunger	Oilwell	1270 psig	58,800 B/D
4 Horizontal Quintuplex Plunger	Oilwell	1050 psig	94,000 B/D

MOTOR MAKE	HP	RPM	DISPLACE- MENT	PRESSION RATIO
4 Waukesha (VLROBU)	500	1025	5788 cu. in.	6.75:1
4 Superior (8G-825)	500	860	6597 cu. in.	10:1

SOURCE WELLS

TYPE OF PUMPS	MAKE	DEPTH	COMBINED CAPACITY
1 Vertical Turbine Peerless	@ 100'		100,000 B/D
1 Vertical Turbine Johnson	@ 100'		

MOTOR MAKE	HP	RPM
2 General Electric	75	1800

SAND SETTLING TANKS

5—3000 Bbl. each

If Pier E injection brings as dramatic a halt—or even a slowing—to subsidence (as has Pier A, subject of Sept. 1959 report), it may well mean quick

check of the most costly malady ever to plague a major oil field. Wilmington experts are now predicting that already-lessening subsidence beneath the Navy's big Long Beach Naval Shipyard (which lies over the area's hardest struck center) may be halted within six months, far sooner than first envisaged. Says Harry E. Ridings, Jr., president of the Long Beach Harbor Commission, "substantial evidence of this . . . comes from our experience with repressuring . . . in the vicinity of Pier A east of the ship yard. Sinkage around Pier A has been decreasing much beyond the normal trend. Also, the area favorably affected has been steadily widening.

Here's the Wilmington subsidence picture in brief: Date subsidence first noticeable: Thought to have commenced 1938, but first evident enough to be of concern 1941.

Present subsidence rate at center of bowl: 0.9' per year (Aug. '58-Aug. '59)

Maximum rate at center of bowl: 2.4' per year (Nov. '50-Nov. '51)

Size of bowl: 20 sq. mile.

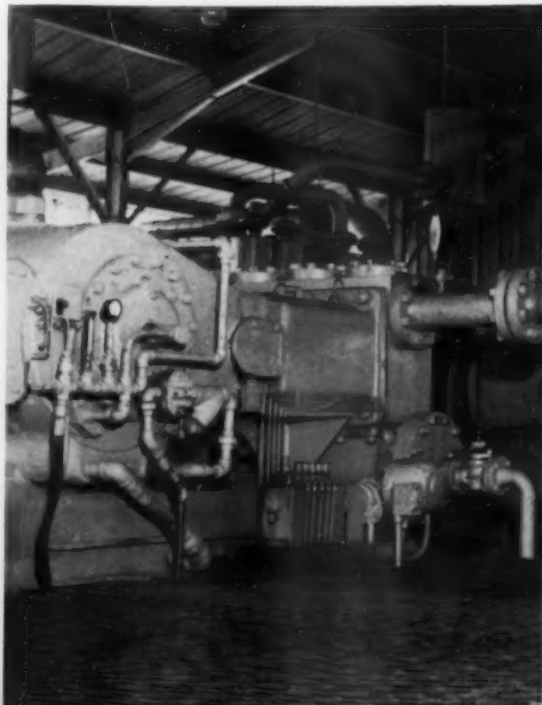
Horizontal movements and tilting:

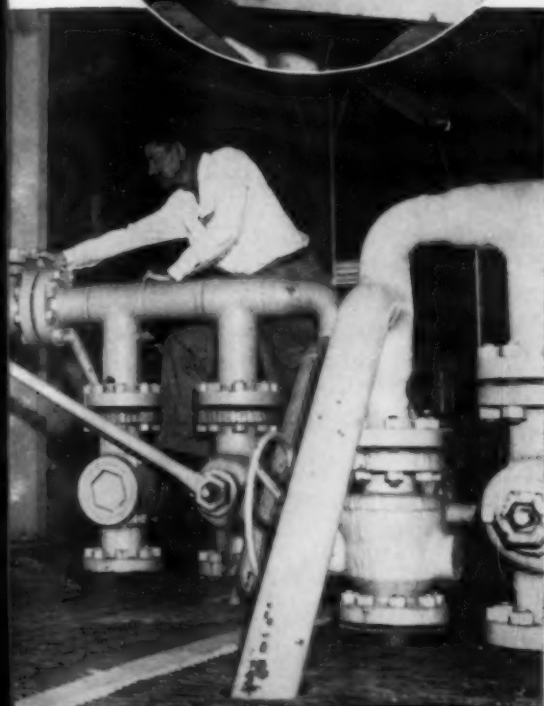
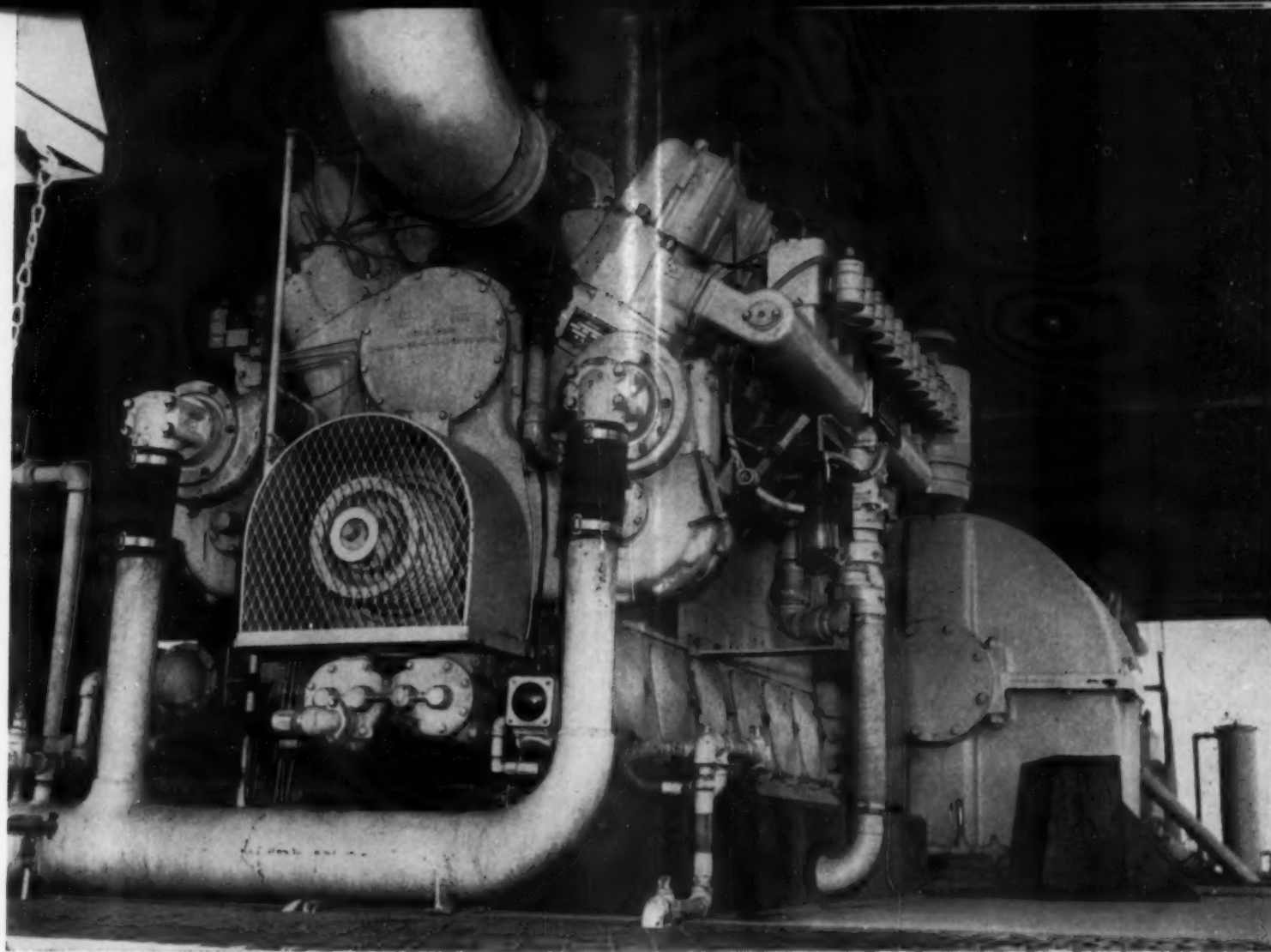
Along a N. 31° E. Line drawn through the center of the depression, horizontal movement from 1949 to 1954 practically equalled those for the 12 year period 1937-1949—total of 9 ft. Sub-surface earth movements were detected by damage to oil well casing and tubing in 1947, 1949, and 1951, and were accompanied by subsurface earth tremors. (Hudson Report 9/57)

Surface manifestations of the horizontal movement which require remedial work are broken pipelines, disrupted sewer and storm drain lines, sudden buckling of railroad tracks, disturbances in pavements, building cracks, etc. It has been necessary to shorten, re-plumb, and jack bridge structures and to cut sections from building and

A unit control panel is provided for each Waukesha gas engine which includes on the panel gauges for cylinder vacuum, lube oil pressure, air starting pressure, engine speed, exhaust temperature, water temperature, lube oil temperature, and clutch air pressure.

Pump end view of Waukesha VLROBU engine driving an Oilwell horizontal quintuplex pump rated 12,500 bbls./day at 2000 psi.





tor here reports $\frac{1}{2}$ more production—and at less cost—than the pre-injection."

"Big Squirts" costs—most of them, at least—have been borne by the City of Long Beach, its injection plants serving both city-owned oil wells (865 of them) and wells privately operated (1981 in all). Plant costs are being recovered thru a surcharge on each barrel of water pumped underground. And no plant operates more efficiently than Pier E, its Waukesha and Superior engines drawing from 2 source wells (tho 2 other stand available) which tap salt water at a depth of about 100-ft. Each of Pier E's Waukesha engines has its own unit control panel which is duplicated in the plant's central control room. Salt water, stored in three Plant E tanks (9000 barrel/capacity in all) and chemically treated (.9 gallon of inhibitor to every 1000 barrels of water), is pumped underground via the injection wells at pressures which vary between 740 and 2000 psi. Injection logs show that each of Pier E's 17 injection wells are putting underground from 1682 to 12,380 B/D.

"Pilot injection . . . begun in 1955 . . . is paying off in 1960 . . . and will continue to pay-off thru the decade upcoming," enthuses a spokesman for the City of Long Beach. The fact that the pay-off has come so soon (far earlier than most engineers predicted) has cast the big gas-fueled engines in the role of heroes. And, in fact, they are certainly that. For \$90,000,000 has already been spent to build dikes, fill land, raise bridges and buildings

and redrill oil wells. Threatened was one of the Navy's largest installations. And, before waterflood's success, the Navy (which came close to closing down its ship yard) and private industry (Ford Motor Co. actually did close its assembly plant) were faced with an additional remedial expenditure of at least \$50,000,000.

Now, however, subsidence's end is in sight. And across a vast and fabulously productive U. S. oil field, engineers and operators are breathing easier . . . while eight injection stations and their big pump engines put water underground to save not only an oil field (Wilmington), a city (Long Beach) . . . but a defense resource—a potential 1.3 billion barrels which still lie beneath the field.

Pier E Equipment List

Engines	Waukesha & White Superior
Pumps	Oilwell
Reduction gears	Western Gear
Air clutches	Fawick
Oil filters	Winslow
Silencers	Maxim
Air cleaners	Vortox
Governors	Fisher
Carburetors	Ensign
Unit Control panels	White and Waukesha
Oil level regulators	Ren (Power Plus)
Spark ignition systems	Bendix Scintilla
Crankcase ventilators	Oildex
Heat exchangers	Ross

FIRST NATIONAL SAE POWERPLANT MEETING

**SAE Schedules Expanded, Highly Informative Program
for Cleveland Meeting With Emphasis on Small
Diesel Engines, Turbochargers, Fuel Controls
and Engine Components**

IF your professional decisions are involved in one way or another with the type of 'small size power plants' that perform the really strenuous jobs in their field, then you will want to attend



Gregory Flynn, Jr.



Ted R. Thoren

the SAE National Powerplant Meeting in Cleveland, October 31 through November 2." This statement by Ted R. Thoren, vice president-engineering of Presco Products Div., Borg-Warner Corp., sums up exactly what SAE members have been talking about for some months. For this will be the first SAE National Powerplant Meeting.

Technical sessions have been planned by the newly expanded SAE Powerplant Activity Committee and the meeting will run a full three days compared to the traditional two. Additional sessions will encompass programs added by the Gas Turbine and Small Industrial and Marine Engine Subcommittees of the Powerplant Activity.

Scheduled at the Sheraton-Cleveland Hotel, the meeting with its expanded subject coverage and feature events, should draw in the neighborhood of 500 members and guests. According to Gregory Flynn Jr., Chairman, Powerplant Activity Committee, and head of General Motors Research Laboratories mechanical development department, the technical sessions will feature papers from the Engine Division of Caterpillar Tractor Co., and American Marc Corp. on new small diesel engines; a report from England on the Coventry Climax aluminum engine, and a symposium on small

turbochargers. Other technical sessions will cover the stress analysis of major engine structural parts.

In addition to the sessions, the meeting has other highlights. On Monday afternoon, following the Caterpillar paper, a tour of the facilities of the Cleveland Aluminum Company of America is scheduled which will reveal the latest techniques for putting the lightweight alloys exactly where your designers must have them. Dinner will be held at the plant and meetings are arranged on stress analysis and aluminum processing. Then, there is a special event for the dinner meeting on Tuesday, November 1. This will be held at the Thompson Auto Album and Aviation Museum with William Hazlet Upson, famed author and lecturer, the guest speaker. His hilarious, but profound topic will be "Ergo-phobia."

Serving with Planning Committee Chairman Thoren, in addition to Greg Flynn, are J. R. Doyle, H. F. Hostetler, T. C. Noon, R. A. Pejeau, R. R. Robinson, R. F. Schaefer, L. L. Young, W. Weinkamer, and SAE Cleveland Section Chairman E. H. Scott.

The Caterpillar D320, one of the new series of small diesels to be covered in the Monday morning session, is used to power this Insley model M excavator-back hoe. The D320 is rated 70 hp at 2000 rpm.



Among the diversified casting and forging facilities at Aluminum Company of America's Cleveland works is the U. S. Air Force Heavy Press Plant, housing two of the world's largest forging presses. Shown here is the larger of the two, the 50,000-ton capacity press. In the background is the smaller 35,000-ton press. The AF plant is adjacent to Alcoa's Cleveland Works and is operated by Alcoa.

The official program is as follows:

MONDAY, October 31

New Small Diesels 9:00 a.m.
Chairman: B. W. Wadman, Diesel and Gas Engine Progress
• Compact New Diesels, F. P. Buttle, D. W. Knopf, and M. B. Morgan, Caterpillar Tractor Co.

Afternoon & Evening Meeting
at Aluminum Co. of America

Buses leave Sheraton-Cleveland Hotel for ALCOA Plant at
2210 Harvard Ave., Cleveland 1:15 p.m.

Tour Alcoa Works and Development Division Laboratory
..... 1:45 p.m.

Aluminum Fabrication—Panel Discussion by Representatives
of ALCOA

Forging: A. E. Favre, Asst. to Forge Plant Manager
Sand Casting: G. A. Purdy, Ch. Inspector, Sand Foundry
Permanent Mold Casting: M. G. Guyot, Div. Ch., Permanent
Mold Engr.

Die Casting: D. L. Kerr, Development Engr.
Plaster Casting Process: W. E. Sicha, Ch., Cleveland Re-
search, ARL

Metallurgy: T. R. Gauthier, Works Ch. Metallurgist

DINNER: ALCOA Cafeteria 5:00 p.m.
Price—\$3.25 \$1.50 for students

STRESS ANALYSIS—Technical Session 6:45 p.m.

• Stress Analysis of Aluminum V-8 Diesel Cylinder Block,
H. W. Van Camp, Sect. Mgr., Stress Lab., Development
Div., ALCOA

• New Techniques in Stress Analysis,
R. M. Law, Experimental Engr., Detroit Diesel Engine
Div., General Motors Corp.

TUESDAY, November 1

Aluminum Engines 9:00 a.m.

Chairman: J. H. Budd, Homelite Div., Textron, Inc.;
Secretary: G. F. Sheppard, British Petroleum Co., Ltd.

• Development of Coventry Climax Aluminum Engines
W. T. F. Hassan, Ch. Engr., Coventry Climax Engines
Ltd.

Design And Development Of Small Turbochargers 2:00 p.m.
Chairman: L. E. Johnson, Caterpillar Tractor Co.

• Design and Development of the Thompson Model 400
Turbocharger, Hugh MacInnis, Ch. Engr., Willoughby
Works, Thompson-Ramo-Woodbridge, Inc.

• Control of Turbochargers, J. M. Casier, Industrial Prod-
ucts Div., AiResearch Manufacturing Div., Garrett Corp.

The main floor of the Thompson Auto Album and Aviation Museum in Cleveland which will be the site of the SAE dinner-meeting. The museum was established by Thompson Products, Inc. as a material record of the achievements and progress of the automotive and aircraft industries.

Noted Author Is Banquet Speaker



Wm. Hazlett Upson

William Hazlett Upson, author of the Saturday Evening Post stories about Alexander Botts, the well-known salesman for Earthworm tractors, will be the guest speaker at the dinner meeting on November 1. Subject of his talk will be "Ergo-Phobia", a provocative topic with a humorous touch that only Upson can impart. Born in Glen Ridge, New Jersey, Upson spent four years studying agriculture at Cornell University which was followed by three years of actual farming experience. Following service with the Field Artillery in the First World War, he joined the Service Department of Caterpillar Tractor Co. His career in the tractor business was interrupted by a serious operation and he never returned. During convalescence he wrote a number of short stories and this was the start of a fabulous career in writing. The Saturday Evening Post has published over a hundred of his stories. Upson has also contributed to Colliers, The Reader's Digest, Nation's Business and many others. He has published eight volumes of collected short stories and his work has been translated into a half-dozen foreign languages. He is one of the great humorists and all of his wit and insight in human behavior will be exposed during his talk on "Ergo-Phobia."

• Design of Elliott Turbochargers, C. F. Harms, Mgr.,
Supercharger Dept., Elliott Co., Div. Carrier Corp.

Dinner 6:00 p.m.
at the Thompson Auto Album and Aviation Museum

Toastmaster—Frederick C. Crawford, Chairman, Executive
Committee, Thompson-Ramo-Woodbridge, Inc.

Principal Speaker—W. H. Upson, Famous humorist and
author of Saturday Evening Post "Earthworm Tractor"
stories

WEDNESDAY, November 2

• Heat Rejection 9:00 a.m.

• New Fuel System

Chairman: W. J. Pelizzoni, Mack Trucks, Inc.

• Evaluating Performance and Heat Rejection of Turbo-
charged Engines, Robert Cramer, Jr., Asst. Ch. Engr.,
Murphy Diesel Co.

• Cummins New PT Pump, Julius Perr, Test Engr., Re-
search Div., Cummins Engine Co., Inc.

DIESEL ENGINES 2:00 p.m.

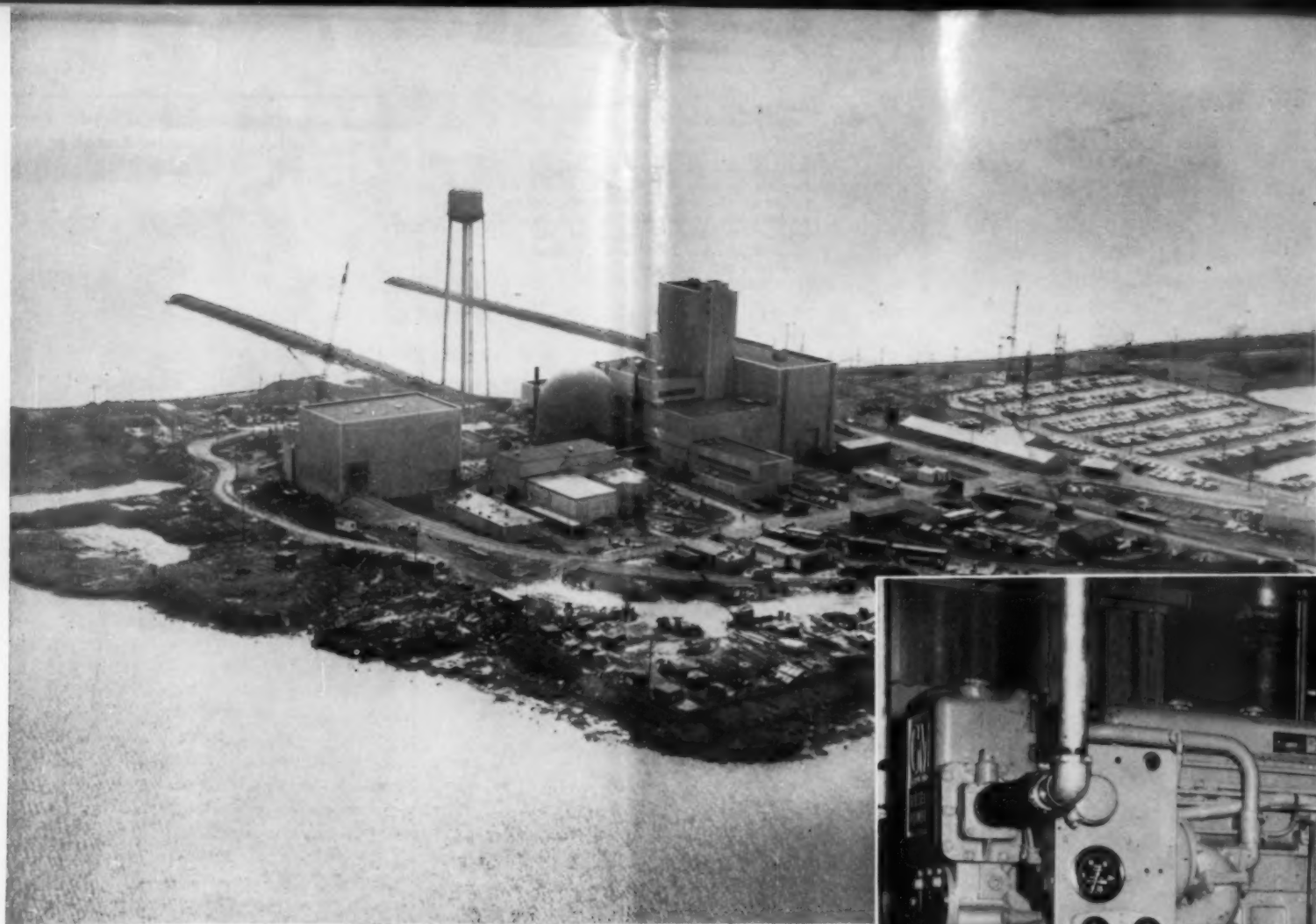
Piston rings—basic design, materials, arrangements.
A new line of diesels with emphasis on two-cycle develop-
ments.

Chairman: R. E. Kennemer, Caterpillar Tractor Co.

• Piston Rings for Transportation Diesels, G. F. Hyde, Ch.
Metallurgist, F. A. Robbins, Mgr., Piston Ring Sales &
Engr., and P. R. Shepler, Ch. Piston Ring Research
Engr., Metal Products Div., Koppers Co.

• American Marc Diesel Engines, Adolf Luerken and Kris
Somhegyi, American Marc, Inc.





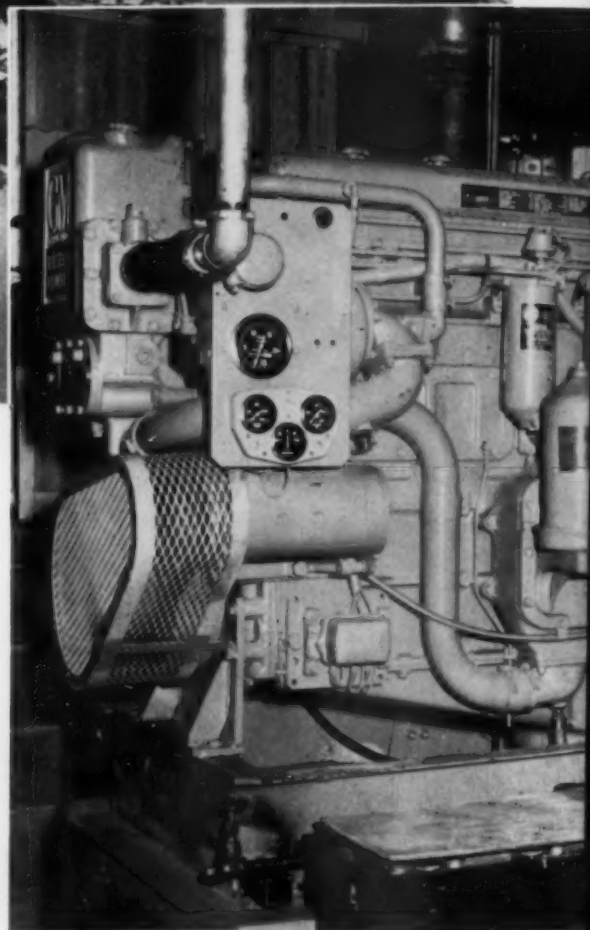
ATOMIC POWER PLANT HAS DIESELS ON STANDBY

By JIM BROWN

THE Enrico Fermi Atomic Power Plant, located on the western shore of Lake Erie near Monroe, Michigan is rapidly nearing completion. This fast-neutron breeder reactor power plant, largest of its kind erected to date, will be able to produce over 100,000 kilowatts constantly from 87 kilograms (approximately 191.4 lbs.) of U235 per year. Since it is a "breeder" type reactor it will also convert part of the "core" and part of the surrounding blanket of uranium-238 into an important byproduct consisting of about 287 lbs. of plutonium yearly. Plutonium is a highly valuable fissionable substance with both peacetime and military defense uses. Once started up, therefore, this plant will not only produce power in commercial quantities but will actually produce more radioactive fuel than it consumes. Interesting to readers of DIESEL AND GAS ENGINE PROGRESS is the fact that this huge public utility, tapping directly the innermost resources of nature presently known to science, will still count on the "standby" power potential of two relatively small high-speed diesel engines to protect production and to prevent and control accidental fires.

The new atomic power plant is being built as a joint effort of Atomic Power Development Associates, Inc., Power Reactor Development Co. and The Detroit Edison Co. Atomic Power Development Associates, Inc., consists of 30 power and light companies from all over the U.S.A. and 12 engineering and manufacturing firms including Allis-Chalmers, Bendix Aviation, Ford and General Motors. Composed largely but not entirely of the same companies is "PRDC"—Power Reactor Development Co., made up of 25 member companies, seven of which are not in the power business. The reactor portion of the plant, with a cost currently estimated at \$63,118,000 is being underwritten by these two organizations.

The electric-power generation portion of the plant is being erected by the Detroit Edison Co. at a cost of approximately \$17,000,000. Total cost of the facility (including \$4,470,000 of fuel fabrication) will be about \$80,118,000, although this is only an estimate. There has never before been a construction job of this magnitude for the peaceful utilization of atomic energy so there are no "bench



marks" for comparison. In addition to the above, the Atomic Energy Commission is contributing important research work evaluated at \$4,450,000 and will waive a "use" charge for fuel of \$3,702,600. It is interesting to note, however, that the government (AEC) contribution is only about 1/10 of that contributed by private enterprise.

Construction of the Enrico Fermi plant, according to the 1959 annual report of the Power Reactor Development Co., may be substantially finished by the time this appears. However non-nuclear testing of component assemblies and other unresolved problems may hold up the starting of the plant until early in 1961.

As may be deduced from some of the foregoing,

◀ Aerial view of the Enrico Fermi Atomic Power Plant taken earlier this year. Lake Erie is in the background; in the foreground one of the lagoons of a long-abandoned real estate development. Power reactor is located in round "dome" in cluster of buildings.

the Enrico Fermi plant will be virtually two separate operations. The fast-neutron breeder atomic reactor will furnish great quantities of heat energy generated by controlled nuclear fission, for conversion into steam. The electric power generating station being constructed along almost completely traditional lines by the Detroit Edison Co. will convert the steam into electric power by means of a large turbo generator. The atomic reactor

◀ This GM Diesel 6-71 heat-exchanger cooled engine provides power for a 3000 gpm Peerless emergency fire-fighting pump at the Enrico Fermi plant.



will heat three "loops" of liquid sodium to about 800° F. Passing through intermediate heat exchangers, these primary circuits will impart about 750° F to a second series of sodium loops which in turn will convert water to superheated steam of 740° F in huge steam generators. Leaving the steam generators, the steam will have a pressure of 600 psia and will go directly to the turbine. The reactor loops and intermediate loops of liquid sodium are virtually unpressurized. The sodium is circulated by 1000 hp pumps. Each pump and motor in these systems stands about 35 ft. tall. The Detroit Edison Company will buy the steam produced by the reactor and the revenue will assumedly be re-distributed among the companies whose contributions made the plant possible.

Start-up, control and shut-down of the atomic fission, and consequently control of the heat generated by the atomic pile, is primarily by means of raising and lowering neutron-absorbing control rods of boron-10 which pass through the core of the reactor. When lowered into the radioactive core, these rods absorb the neutrons and slow down the splitting of the atoms.

The control rods are vertically arranged and will fall into place by gravity when controls are "cut off." Five alternate means, in the order named, are provided to supply power to the complex electrical control system: the main 100 mw turbo generator, utility power from two outside sources, a model D375 Caterpillar electric generator and a bank of batteries.

The standby diesel power unit is provided for use as a means of energizing essential loads during and after a shutdown or a fuel loading cycle. It is a Caterpillar 8 cylinder D375 generator set with a 480 volt, 60 cycle, 1200 rpm Electric Machinery generator, type BRKT rated 312 kva at 0.8 pf. The engine is turbocharged with a Caterpillar turbocharger and at 1200 rpm it is rated at 325 continuous hp. It is equipped with 36 volt twin starting motors, a Chromalox jacket water heater which keeps the jacket water temperature at a constant 140° F; Woodward governor, Maxim silencer and Donaldson air cleaner. The engine is cooled by a radiator which is located on a roof

about 60 ft. above the engine and connected to it by large copper tubing.

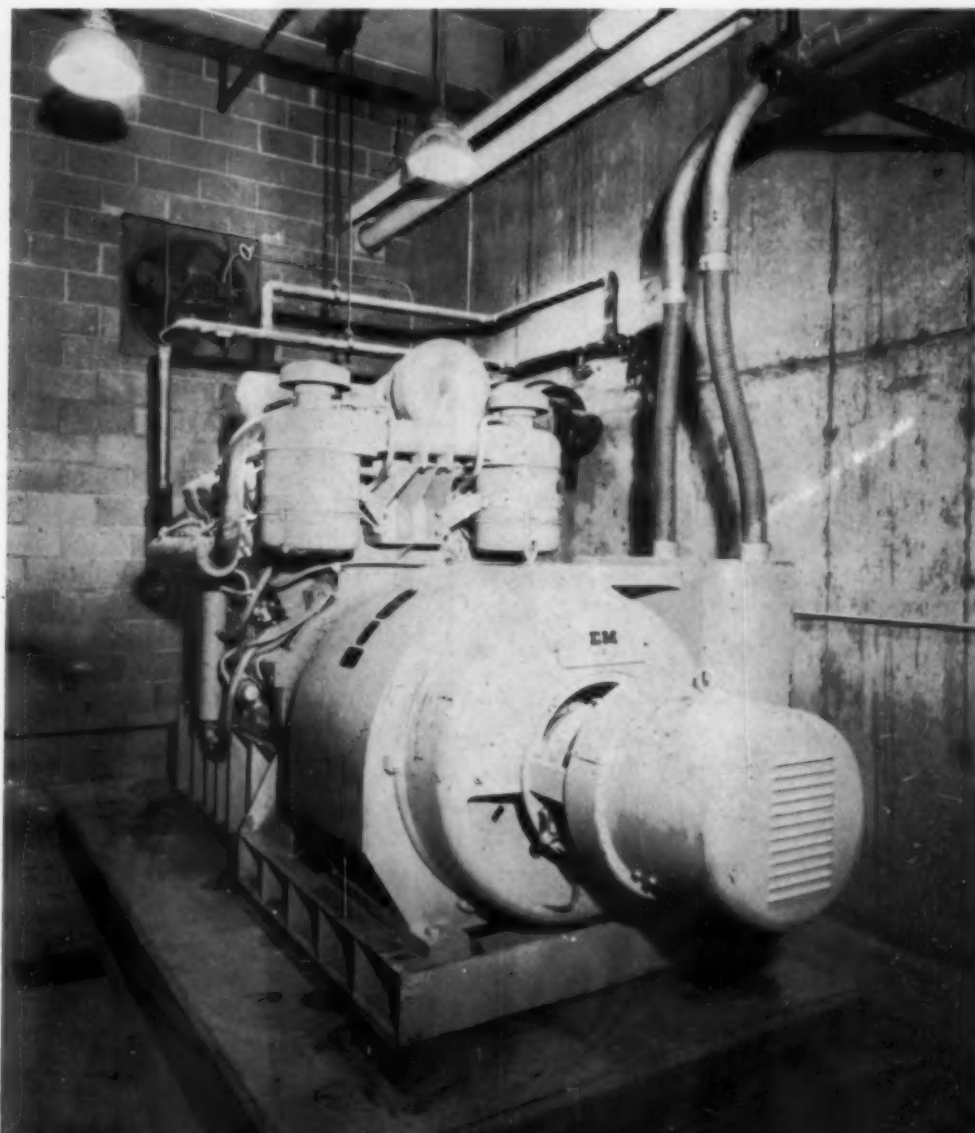
The diesel generator set is started automatically when the voltage supplied to the "diesel bus" falls below its normal 480 volts. When generator voltage becomes normal a breaker at the generator set closes and the diesel generator takes on the diesel bus load until normal power is restored.

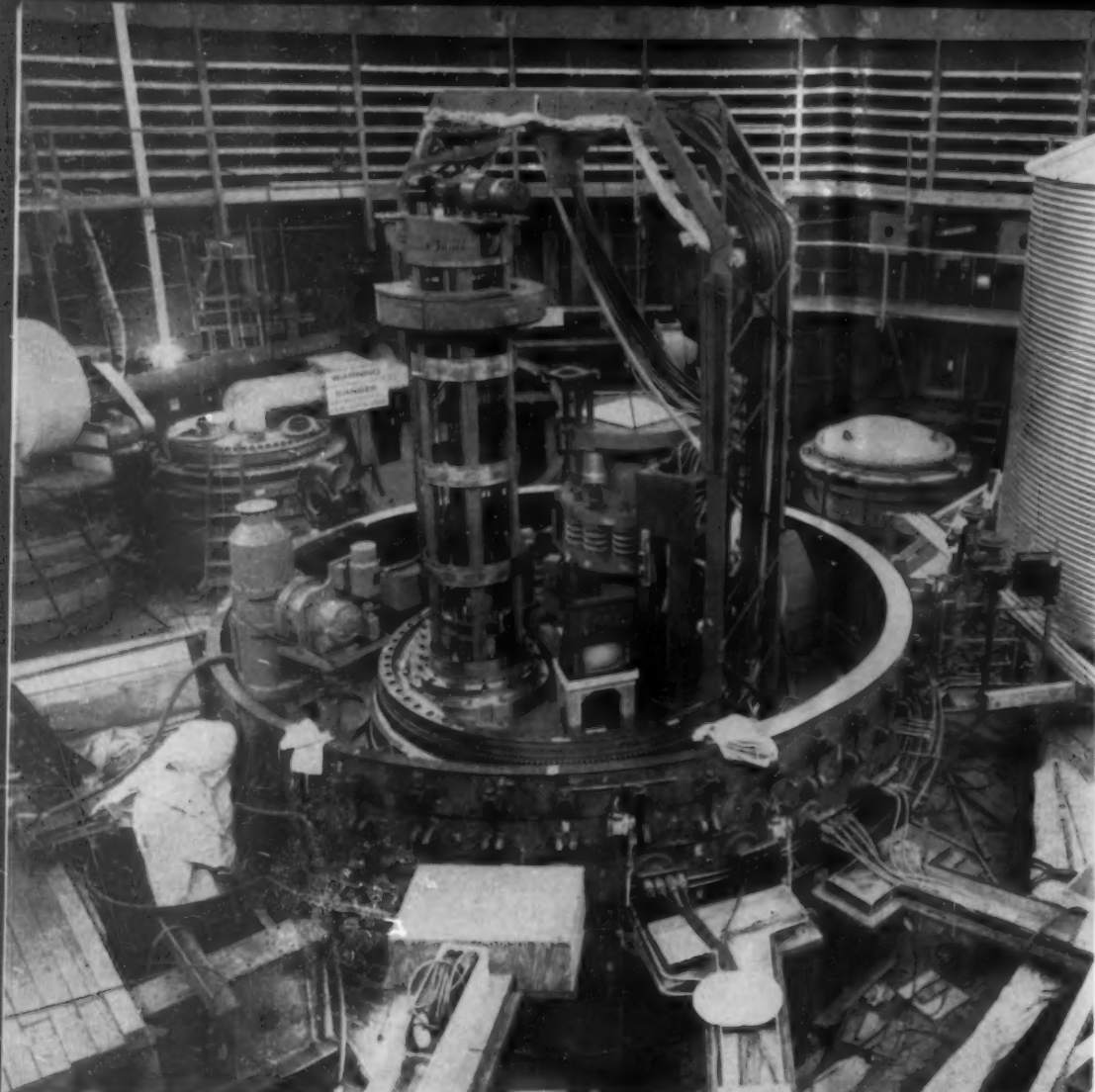
The diesel bus load includes many essential services such as a series of motors on the safety rod drives; the offset handling crane which loads and unloads the atomic pile; container and floor valves in the container building; an emergency compressor for control air; sodium pump shaft seal oil pumps; main steam non-return and by-pass controls; cask car emergency operation; the containment building crane, and television cameras, lights and monitors which are strategically placed for observation. In addition, the diesel bus load includes an exhaust fan to prevent overheating of the diesel room during prolonged operation.

Diesel Drives Fire Pump

The second diesel standby engine is a GM 6-71 heat-exchanger cooled diesel engine connected to a Peerless 3,000 gpm vertical pump and arranged to "cut in" automatically in the event water pressure in the fire mains should drop below 85 psi. The engine is installed in the "screen house"—the water intake and pumping facility which sup-

Caterpillar D375 emergency generator set in the control building at the Enrico Fermi Atomic Power Plant.





Closeup of the power reactor, inside a gas-tight building, during construction and preliminary testing.

plies cooling water, general utility and drinking water for the whole plant.

To provide clean water for the Enrico Fermi plant, a 3,000 ft. concrete-lined canal was built out into Lake Erie, and a screened inlet provided. There are three 200 hp electrically driven general service pumps of 3,000 gpm capacity each and two 400 hp Allis-Chalmers 66,000 gpm circulating pumps which furnish cooling water for the turbo generator condenser.

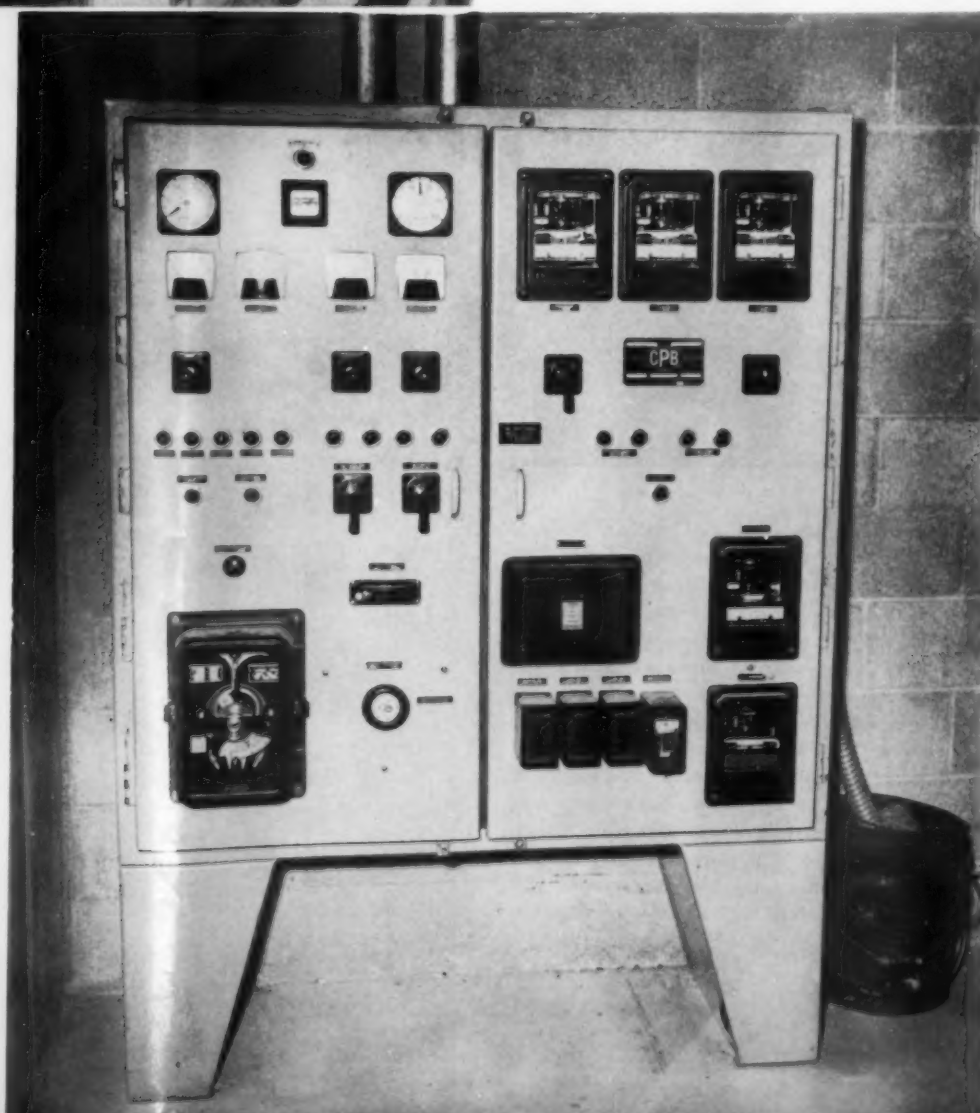
The fire mains to which the diesel-driven pump is connected serve 18 fire hose connections inside the Detroit Edison turbo-generator building; a number of hose connections in the plant service building; 11 outside hydrant connections and six sprinkler systems, some of which are automatic and some remote controlled.

The GM Diesel driving the standby fire pump is equipped with King-Knight automatic controls. A unique feature of this automatic starting system is that it employs two sets of 24 volt batteries and cranks the engine first from one set, then the other. In case of failure or reluctance of the en-

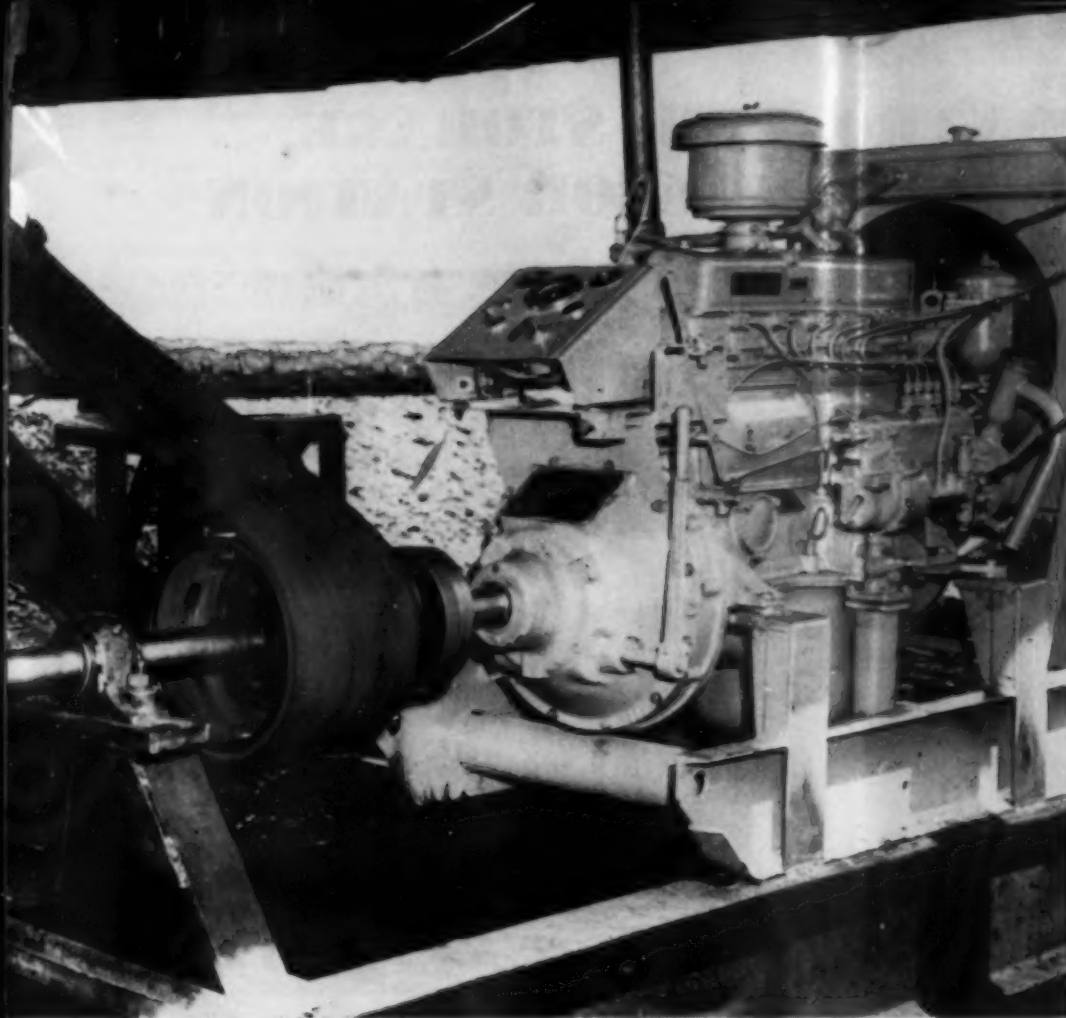
gine to start immediately it would be cranked for 10 seconds on one set of batteries, then 10 seconds from another and so on for a total of 90 seconds. If the engine should fail to start within this period the control circuit is deenergized and an alarm is sounded in the screen house.

The standby fire pump is brought into play automatically by either one of two conditions: Loss of pressure (below 85 psi) in the fire main or loss of power feed to the electrically driven general service pumps. The GM diesel on the fire pump is protected by automatic shut down in case of overspeed, low oil pressure or high cooling water temperature. The starting batteries are charged by the engine generator when the engine is operating and by a trickle charger which switches automatically every hour from one set of batteries to the other when the engine is not operating. Current plans are to give the fire pump a weekly test run by purposely creating a low pressure condition in the fire main.

The Caterpillar diesel standby generator set was furnished by Michigan Tractor and Machinery Co., Caterpillar distributors in Detroit. Michigan Tractor and Machinery Company also erected the generator control panel, one feature of which is a Brown-Boveri field regulator. The GM Diesel standby fire pump engine was furnished by Peerless Pump Division, Food Machinery and Chemical Corp., with the pump. The installation inspection of the engine was performed by Peninsular Diesel, Inc. of Detroit, and they will be responsible for future inspection and servicing.



Control panel for the Caterpillar generator set, furnished by Michigan Tractor and Machinery Company of Detroit.



The Mercedes-Benz model OM 321 diesel engine supplied by Power Inc. for the Glades Lumber & Wood Treatment Co. and used as the main source of power for their pole stripping machinery. Installation also included Twin Disc clutch. No muffler is used as the plant is out in the woods. This 92 bhp diesel replaced a 125 hp. engine.

DIESEL CUTS FUEL COSTS FOR POLE STRIPPING

By ED DENNIS

FEW visitors to the Sunshine State realize that Florida is one of America's leading lumber states and that its annual wholesale manufactured value of forest products amounts to almost 450 million dollars.

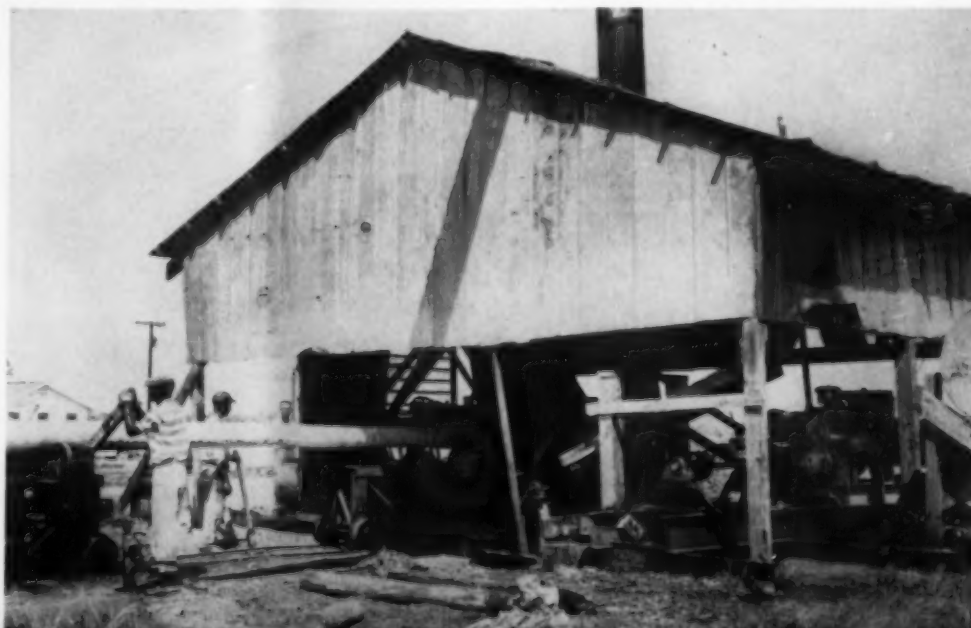
The Glades Lumber & Wood Treating Co. plant at Fort Myers, Florida is typical of the 600 odd small saw mills operating in the Peninsular State which produce lumber and lumber products at the rate of over 500-million board feet a year. This firm, instead of sawing the logs into boards, strips and pressure-treats them for use as telephone poles and foundation pilings.

In order for these small lumber mills to turn a profit, an extra sharp eye must be kept on each phase of mill operation. According to C. H. Simmons, president of Glades Lumber, use of a diesel engine as the main source of power on its pole stripping machinery has substantially improved his firm's operation in this unique phase of the Florida lumber industry.

In September, 1958 the company repowered their pole stripping machine with a model OM 321

Mercedes-Benz diesel engine. This six cylinder industrial power unit is of the four cycle design with a piston displacement of 311 cu. in. and a bhp of 92 at 2600 rpm. Since the new installation

The pole stripping shed where they can strip and trim a 50 ft. log in about 5 minutes. Its capacity is about 125 poles or 3000 lineal ft. per day.



fuel oil consumption has dropped to about four gallons per hour or about two-thirds less than for the old installation.

The plant operates about eight hrs. a day and produces 100 to 125 class 435 poles or approximately 3000 lineal feet of poles. The pole stripping machine can strip and trim a 50 ft. pole with an average diameter of 11 in. in about five minutes. One man controls its operation with three helpers feeding and handling the poles.

A blower driven off a drive shaft pulley removes the sawdust and pole shavings to a stockpile from where it is carried periodically, to the steam plant to be used for fuel in the plant's furnace. The poles are pressure dried and pressure treated with creosote at the plant and then stock piled in the yard awaiting shipment via trucks or trailers to the construction location. This firm also specializes in osmose pressure treated lumber products.

Since its installation, the new diesel has not only cut the fuel bill by two-thirds and increased the plant's production over its former power unit, but it has also given the Glades Lumber Co. management almost two years of freedom from down time since it has required no maintenance to date. Every 100 hrs. the lubricating oil and filters are changed and air intake filters are cleaned.

The firm also operates a Mercedes-Benz dieselized Dodge truck which hauls lumber from Georgia to Florida at a savings of \$4 per 1000 lineal feet over its former gasoline engine. The truck's capacity is 18,000 ft. of lumber per load.

The pole stripping dieselized installation was engineered by Power Incorporated of Fort Myers and included Twin Disc clutch, Link belt, self alignment pilot bearings and a 500 gallon fuel oil tank. The 12 inch "I" beam foundation has adjusting screws for belt adjustment.

REMOTE CONTROL FOR STORAGE, DISTRIBUTION COMPRESSOR STATION

By DWIGHT P. ROBISON

THE East Ohio Gas Company has installed an automated engine-compressor station which has given excellent performance in its storage and distribution system. This innovation, which includes a Cooper-Bessemer GMXD-10 gas engine angle compressor unit, was installed in Spring, 1959, at the gas company's Columbiana Station near Damascus, Ohio. It consists of a 10-cylinder "V"-type gas engine, and five horizontal compressor cylinders, as well as a large radiator for cooling engine water, lube oil and compressed gas, all mounted on a steel skid in one compact unit.

Twenty-six miles away, at Robinson Station near Canton, Ohio, is a master control unit which controls the engine. The unit is used to pressurize a gas storage field.

Cooper Bessemer 660 hp model GMXD-10 gas engine compressor installed at the Columbiana Station of East Ohio Gas Co. This unit is equipped with a Cooper Bessemer En-tronics control system for remote control and automatic operation.

Auxiliary Control panel at remote station is installed in room next to engine-compressor installation. This panel receives telemetered signals from master control point 26 miles away and relays to engine as well as sending signals from engine unit back to master control point. Telephone equipment is included for talking direct to master control point.

With 660 hp rating, the GMXD-10 is operated at 450 rpm. Its 10 power cylinders have a bore of $9\frac{3}{4}$ in. and a stroke of $10\frac{1}{2}$ in. The five compressor cylinders have a bore of $5\frac{1}{2}$ in. and a $10\frac{1}{2}$ in. stroke, enabling the unit to pump 15,000 Mcf a day into the area's seventeen storage wells, up to a 1450 psi maximum injection pressure. The unit was skidded and packaged with all necessary piping by C-B Southern, Inc., a wholly-owned Cooper-Bessemer subsidiary.

This equipment has reduced operating costs considerably. The new unit operates with a fuel consumption 30 per cent below that of the plant's original equipment. Important savings in labor costs have also proved this installation practical. The new 660 hp unit replaced two 470 hp engines and has shown more than adequate capacity for handling the gas compression job required.

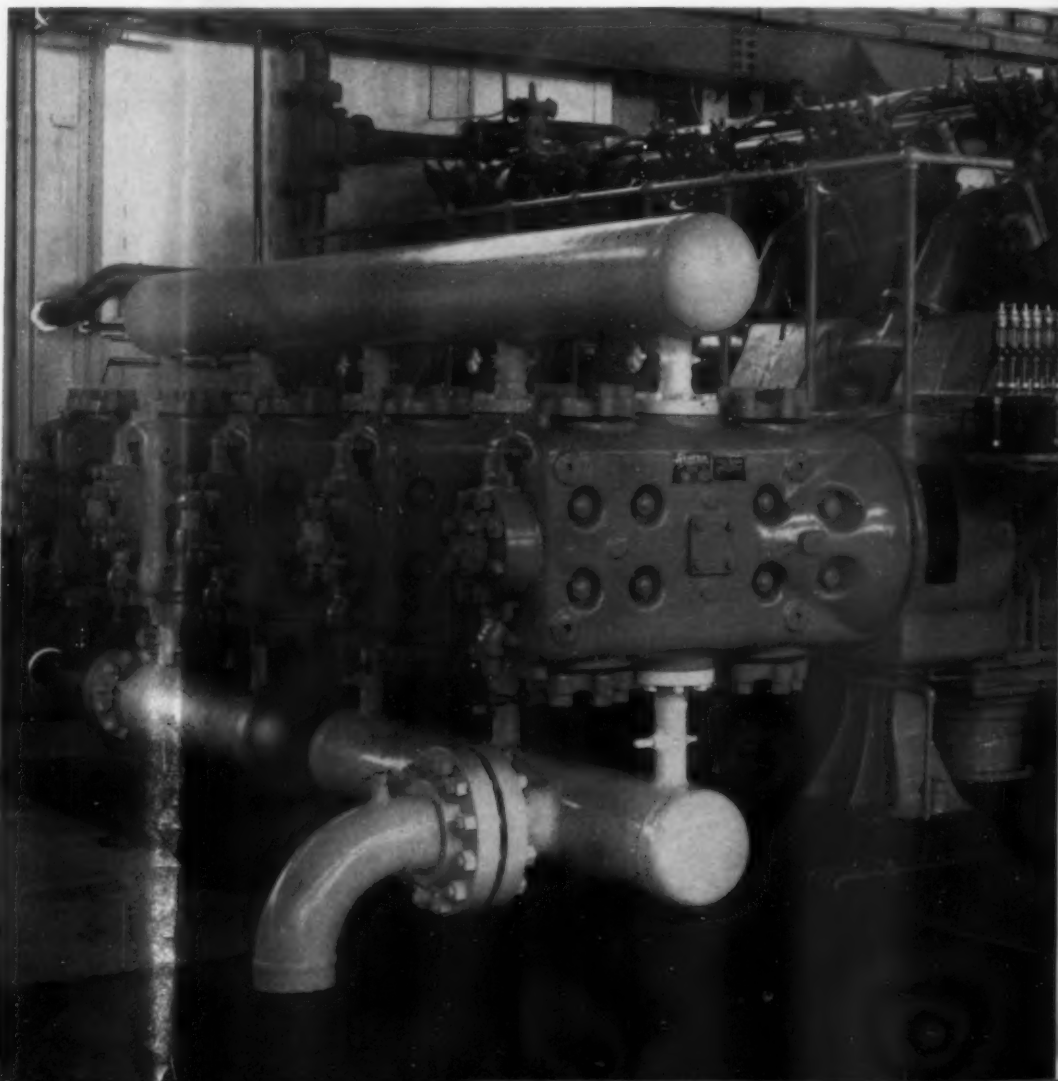
The heart of the remote control system is a group of three En-Tronic Control panels also engineered

and built by Cooper-Bessemer. The system consists basically of the following:

- 1—Master Station Control Unit—at a point 26 miles distant from the unit it controls.
- 2—Master and Remote Stations' Auxiliary Control Units—at both points.
- 3—Remote Station Engine-Compressor Control Unit—installed next to the engine at Columbiana Station.

The controls system operates as follows:

1. Master Station Control Unit—From this panel the engine can be started or stopped, and suction and discharge pressures are continuously recorded on a Bristol Recording instrument. Lights (indicating the conditions of the engine, the remote power supply, and the telephone circuit used as a link between the master and remote control panels) are provided here. Also mounted here is the emergency stop pushbutton. Supervisory controls are monitored on the master control panel. An indicating light shows when the unit has been

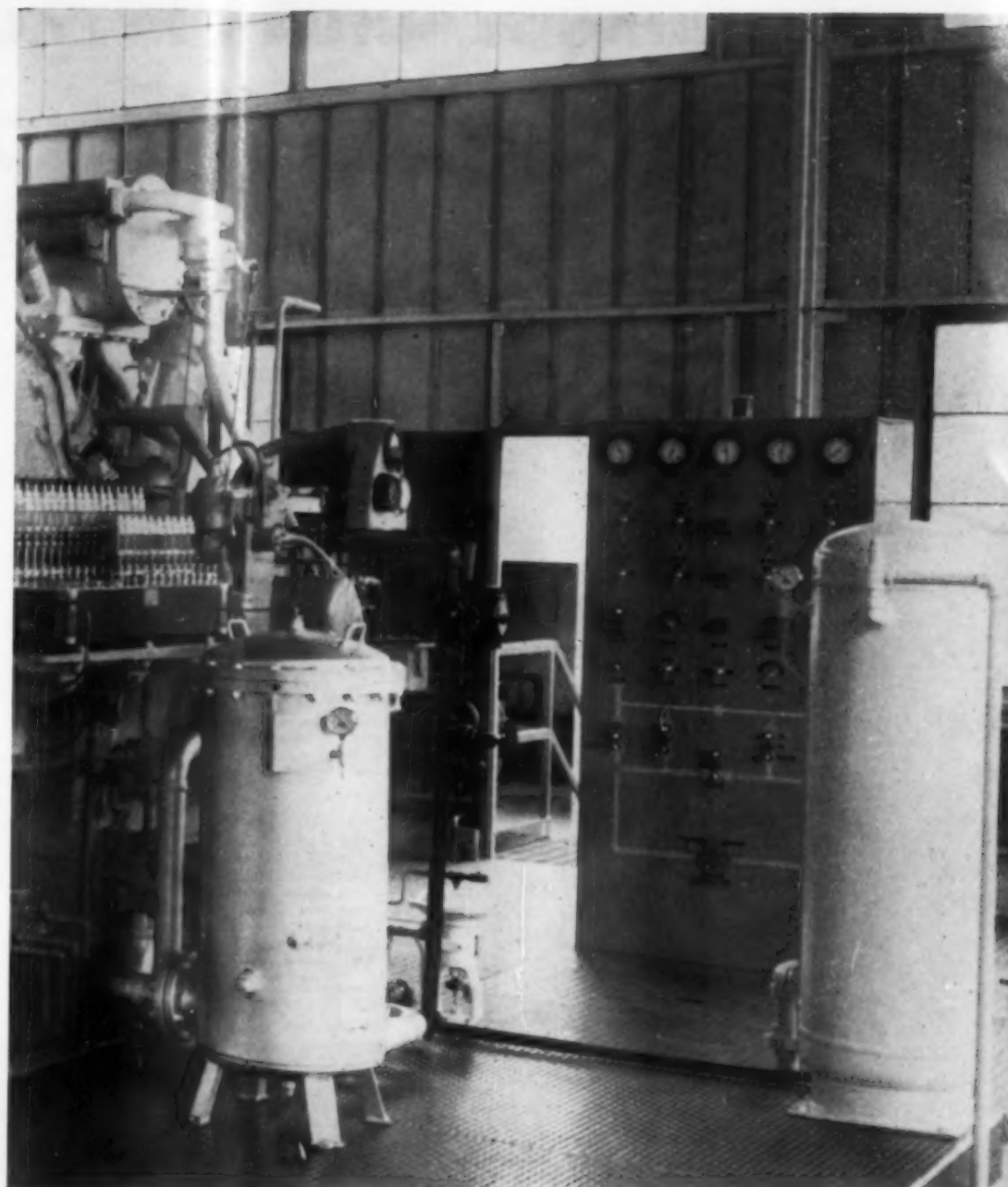
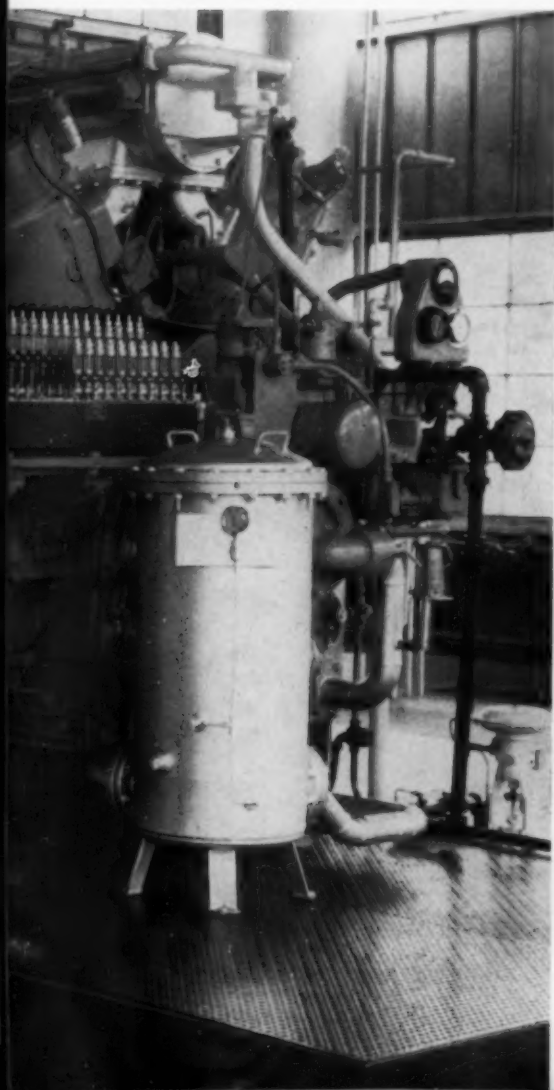


stopped due to a possible malfunction. A direct telephone link between the master and remote panels is provided on the same pair of telephone wires over which other control functions are carried.

2. Master and remote auxiliary control units—These panels, one at each point, house the necessary complementary tone control equipment. The remote panel receives signals from the master panel and continuously transmits suction and discharge pressure information, as well as engine condition information to the master panel. They also contain the telephone equipment.

3. Remote station engine-compressor control unit—Housed in this panel is all the control equipment needed to start, operate and shut-down the main unit. Included are:

- a. Indicating lights to duplicate those on the master panel.
- b. Amot pneumatic shutdown indicators for engine overspeed, low lube oil pressure, high jacket water pressure and high ambient air temperature. Amot shutdown controls for these purposes are installed on the engine. Also provided is an indicator showing when the unit has been stopped in its startup by an incomplete starting sequence. This consists of:
 - (1) Ignition on
 - (2) Fuel gas on
 - (3) Engine running and on line.
- c. Controls are provided here for remote operation, local sequential operation or entirely manual operation. The engine can, thus, be operated in any of three ways and the infor-



mation regarding the method of operation is at all times relayed to the master panel.

- d. A diagram of the compressor lead piping is included in this panel with red and green lights indicating the position of the five valves which must be operated sequentially in starting the engine. These are:
 - (1) Main Suction Valve
 - (2) Main Discharge Valve
 - (3) Bypass Valve
 - (4) Blowdown Valve
 - (5) Pressurizing Valve

Switches for manual operation of these valves lie under their respective lights.

Five indicating pressure gauges are also included. They are:

- (1) Starting Air Pressure
- (2) Control Air Pressure
- (3) Fuel Gas Pressure
- (4) Suction Pressure
- (5) Discharge Pressure

View of engine room showing engine-compressor En-tronics control unit. This panel is equipped with Amot pneumatic shutdown indicators. Housed in this panel is all control equipment needed to start, operate and shut down the main engine.

The engine operates normally during the warm months, from May through October. There is only intermittent operation in December, and gas is fed out of storage through the first three months of the year. In April a check is made of the wells and the unit is readied for another season. Accessories on the GMXD-10 unit were added when the unit was piped and skidded by C-B Southern as a complete package. The package consists of the complete compressor unit prefabricated to include all auxiliary equipment such as jacket water cooling, lube oil cooling, gas cooling, full flow oil filter and complete starting and operating accessories. All necessary pumps are built-in, direct-driven from the engine. The entire unit was shop assembled, mounted on a structural steel base and shipped as a completely packaged compressor unit.

BUILDING FLORIDA'S EVERGLADES ROAD

Road Through Watery Wilderness Requires a Fleet of Boats as Well as Dieselized Roadbuilding Machinery

By ED DENNIS

ABOUT 15 miles west of Miami, Florida, is a wild and watery wilderness called the Florida Everglades and across this vast sea of grass the L. C. Morris Inc., construction engineers is constructing the southern half of State Rd. No. 27. This southern half will meet the northern portion about 8½ miles north of the Tamiami Trail and together the two sections will provide a by-pass for traffic away from Miami and the Gold Coast. It will provide a short cut between the Florida Keys and Central Florida. The construction job was awarded on a low bid of \$1,481,643.30 for the 8.485 mile southern section.

One of the oddities of the overall job is the

number of boats required for this road construction job. Ten outboard motorboats are used for personnel and supplies, one fuel oil barge and two dynamite barges plus an airboat that can skim over water only inches deep at 40 mph.

Due to the considerable number of pieces of dieselized equipment (about 40) being used on the job and the good operational teamwork, this section will probably be finished before the deadline which is the middle of February 1961.

Working wasn't easy for the State Road Department survey team. Mosquitoes, rattle-snakes, alligators and hundreds of water moccasins made

their job very interesting each day as they worked in two and three feet of swamp water. A good part of the new road runs alongside levee and canal No. 30 of the Central & South Florida Flood Control Project and this canal was utilized for most of the borrow fill.

The work pattern used consists of a Caterpillar dieselized model 38B Bucyrus-Erie three yd. dragline and a GM dieselized Lima dragline to strip the overburden muck from the right of way, followed by two barges, in the canal, each equipped with a Mayhew drill rig for drilling and dynamiting. One of the drilling rigs is powered by a General Motors 4-71 diesel and the other by a gasoline engine, but as Jack Morris explained, "as soon as the gas engine blows up or wears out we'll replace it with a diesel".

After the dynamiting, a Cummins dieselized, model 1201, Lima dragline scoops borrow fill from the canal to make a temporary roadbed alongside the right of way for what is called their "Pride and Joy", a model 4500 Manitowoc dragline powered by a model D397 Caterpillar V12 diesel engine

◀ No. 4500 Manitowoc 4½ yd. dragline with a 150 ft. boom and powered with a model D397 Caterpillar diesel rated 440 hp at 1200 rpm. This V-12 Cat, with a bore and stroke of 5.75 x 8 in., consumes about 12 gals. of fuel per hour and digs about 2000 cu. yds. in a 23½ hr. day. It is equipped with a 5 kw Sheppard dieselized generating unit for night operations.



rated 440 hp at 1200 rpm. This long boomed (150 ft.) dragline, with huge tracks, scoops rock at the rate of $4\frac{1}{2}$ yds. a minute from the man-made drainage canal and stockpiles it along the right of way. It moves almost endlessly, (the machine completes a cycle a minute) $23\frac{1}{2}$ hours a day, scooping about 2000 cu. yds. and moving about 200 feet in a forward motion during that time. A 5 kw Sheppard dieselized generating set mounted on the machine turns night into day for this around the clock work horse.

The sixth phase of this operation centers around the east end of the main stock pile. This stock pile was being serviced by a No. 6 Northwest dragline powered with a model 20 Murphy which loaded the rock material onto Mississippi, 10 yd. bottom dump trucks pulled by General Motors dieselized (4-71) tractors to deliver the material directly to the roadbed where an army of motor graders, dozers and rollers level the rock material continually in clocklike precision.

Jack Morris explained, "in this business where you get work by competitive bidding, equipment must stand the tough grind month in and month out. That's why we replaced our gasoline powered dump truck with GM dieselized rigs. The gasoline trucks had too much down time and ate up twice as much fuel as our new diesel outfits."

The company is currently operating about 40 pieces of equipment on the job. Breakdowns are kept at a minimum as they have a service truck and an oil barge for oil changes and service work checking the machinery regularly.

Fuel oil consumption on some of the main pieces of equipment runs about as follows: the 440 hp



Two Galion Chief, 12 ton, three wheel, rollers with Roll-O-Matic torque converters and UD350 International 4 cylinder diesel engines rated 75 hp at 1800 rpm.

One of the two dynamite rigs operating on the canal alongside road right of way. The canal is being used as a borrow pit. The Mayhew drill rig is powered by a GM 4-71 diesel engine.



Caterpillar powered Manitowoc $4\frac{1}{2}$ yd. dragline—12 gph; the 1201 Lima Cummins dieselized 3 yd. dragline—5 gph; the 34 B Bucyrus-Erie GM dieselized dragline—30 gal./10 hr. operation; the 38 B Bucyrus-Erie 3 yd. Caterpillar-powered dragline—30 gal./10 hr. operation and the GMC tractors that haul rock material—18 gal. for a 9 hr. day.

The oilers on each dragline change lubricating oil and filters each 200 hrs. of operation. They also take care of air filters, fuel oil strainers and any minor engine or machinery adjustments needed.

All maintenance is done in the field on the large pieces of equipment by Ed Grow, maintenance foreman, and a crew of heavy duty field mechanics. Major repairs needed on the small equipment is done at the company shop in Miami. They can't afford to have machinery that breaks down way out in the snake infested "Glades" so they keep a good preventive maintenance program in operation.

Fuel and supplies for the four forward draglines are either brought up on the oil barge or on one of several personnel boats.

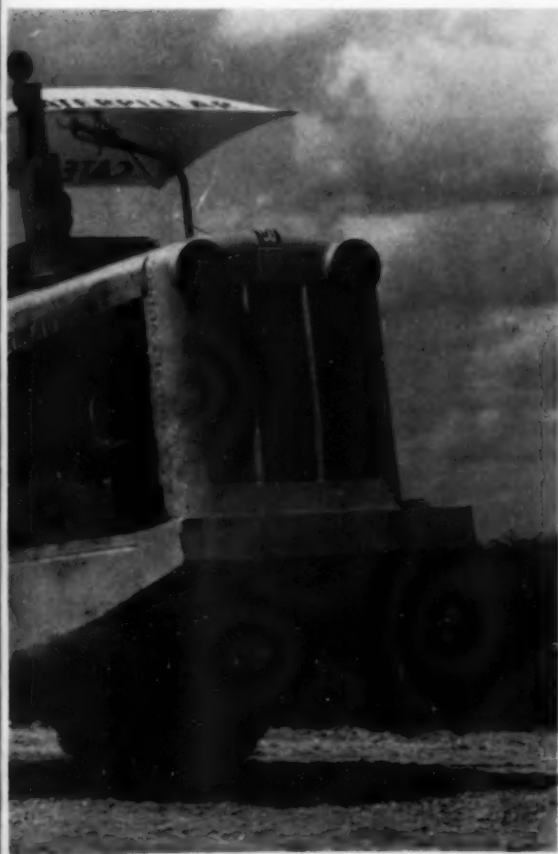
Looking about the job, and from Jack Morris, we obtained the following information about the

One of two LeTourneau-Westinghouse model C tractors powered with GM 6-71 diesels. They pull 12 yd. scrapers and also are used to pull grade rollers. They have 5 speed transmissions and are electrically controlled.

other equipment used on an average day at the construction site, one Scoopmobile with a Waukesha 95DLC diesel, two Galion 12 ton rollers with UD350 International diesels, two TD18's, two TD-20's and one TD24 International dozers, four Caterpillar motor graders, two Mayhew drill rigs mounted on barges, two LeTourneau-Westinghouse Tournapulls and tractors plus several other pieces of equipment.

The new road will have a 24 ft. paved surface and 10 ft. shoulders with a 6:1 slope. The base of the road will be approximately 100 ft. wide. The surface pavement will be of approved asphaltic concrete type #1, the base material will be of $8\frac{1}{2}$ inches compacted lime rock placed on 12 inches of stabilized subbase rock compacted to a Florida bearing of at least 75 psi. The job calls for the construction of one concrete bridge about 80 ft. long near Tamiami Trail.

Jack Morris is supervisor for the road base work, Lee Sapp supervises the finished work and Ed Grow looks out for the maintenance work on the machinery. Max Breeden is the project engineer for the state road department.



CATERPILLAR ENTERS TRUCK MARKET WITH 220 HP ENGINE

By BRUCE W. WADMAN

PEORIA, Illinois—Caterpillar has now announced its entry into the trucking field and here at the Engine Division's Mossville plant, I had my first complete look at the new 220 hp diesel that marks an important milestone in the development and expansion of the Caterpillar engine line.

Caterpillar has been a leading builder of diesels for major high speed engine applications for many years, with the high volume trucking market as the one chief exception. With the introduction of this new truck diesel, they bring to the trucker an engine specially engineered and built for the application and embodying many proven Caterpillar design features. Important among these, for example, are, the pre-chamber type combustion system and advanced utilization of turbocharging and aftercooling for top engine performance.

The new engine, designated the model 1673, is a six cylinder, four cycle diesel with a bore of 4.5 in. and stroke of 5.5 in. The engine, turbocharged and aftercooled, is rated 220 hp at 2200 rpm. It is available also in ratings between 180 and 220 hp to meet needs of specific applications. Displacement is 525 cu. in. and compression ratio is 18:1. Maximum torque is 587 lb. ft. at 1700 rpm (lugged down from 220 hp at 2200 rpm.)

Mr. H. H. Howard, vice president and general manager of the Caterpillar Engine Division has stated as follows on the objectives and policies

of this truck diesel program, "This compact engine fits almost every make truck in its horsepower range. Its design incorporates the longevity which Caterpillar has built into hundreds of thousands of diesels used throughout the world. We intend to continue our aggressive program in diesel engine design and manufacture with this, and later other sizes of truck engines."

Mr. Fred V. Jacobs, sales manager of the Engine Division has also given us information on the sales and distribution arrangements that will be followed with the truck diesel. He says, "In our market research we have contacted a large number of people in the truck trade and many have said that they wanted a Caterpillar diesel truck engine. We are now offering the 1673 to truckers through Caterpillar dealers and truck manufacturers. Dealers in the United States and Canada are marketing the engine during 1960. Our plans also include other sizes of truck power units, both larger and smaller than the 1673."

The horsepower range of the 1673 is within the most popular range of diesel applications in over-the-road trucks. These are trucks with gvws of 26,000 lbs. or more and gcws of 50,000 to 75,000 lbs. Truck types in this engine's class include most semi-trailer tractors, ready-mix concrete trucks and heavy dump trucks (five to ten yard). Prominent makes of trucks in the weight class for the 1673 include Mack, White, International Harvester, Diamond T, Kenworth, Hendrickson, Brockway,

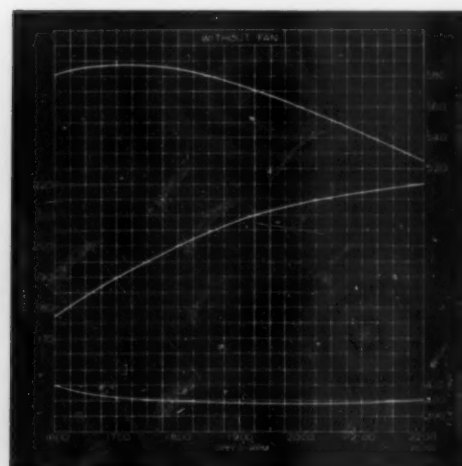


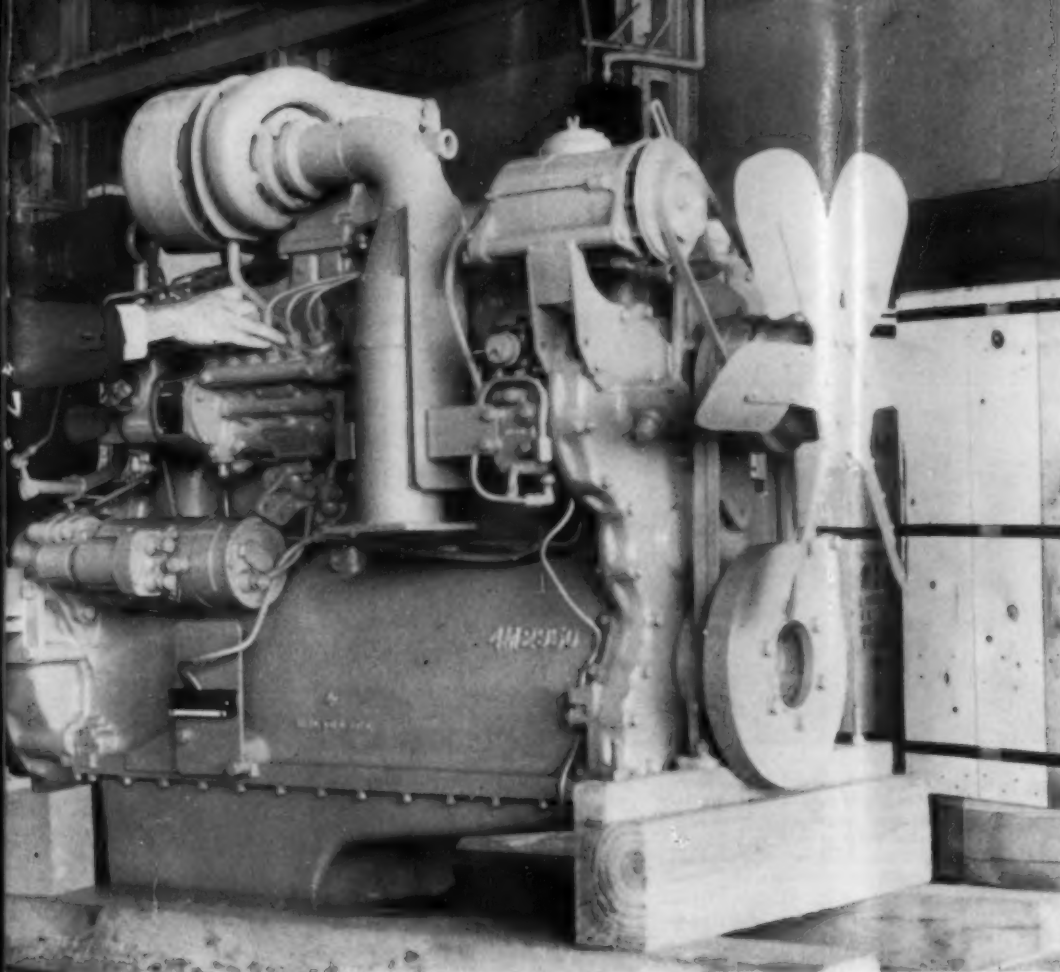
Peterbilt and some new models coming into this class from Ford and Dodge. The 1673 is designed for heavy duty highway service and maintains its full horsepower output up to 5,000 ft. elevation. Above 5,000 ft., horsepower output is derated approximately 3 percent per 1000 ft.

Now, let's get into a closer analysis of major features of this engine, and what they mean to the truck operator.

◀ Schematic cross section of the Caterpillar fuel system showing design of precombustion chamber to left. Note simplicity of design and large orifice in fuel injector.

Performance curve of the 1673 engine. ▶





J. G. Edwards (left) Chief Engineer and Fred V. Jacobs, Engine Sales Manager, look over one of the production models of the new truck diesel. Engine is equipped with Schwitzer turbocharger and fan, and Delco-Remy 24 volt starting motor and 12 volt Alternator.

with the naturally aspirated engine. This lower exhaust temperature indicates lower internal engine temperature due to the great increase in airflow. These lower temperatures contribute to long engine life. After-cooling permits even more efficient use of turbocharging.

Combustion and Fuel System—The pre-chamber combustion system is basically a Caterpillar engine feature of long standing. It has been adapted especially for the requirements of truck application. Larger openings between pre-chamber and main combustion chamber and earlier injection of fuel on the compression stroke are among the special fuel system changes for this engine. Combining the tailored turbocharging and fuel system designs, the engine boasts a very respectable fuel consumption rating of .398 lbs. per bhp/hr, as shown in the accompanying performance curves.

In the Caterpillar fuel system, the pre-chamber is located in the head with plenty of cooling water capacity surrounding it. Fuel is injected into this chamber through a simple, single orifice injector. Initial burning of the air-fuel mixture is accomplished in the pre-chamber. This forces the remaining fuel into the main chamber above the

Turbocharging and Aftercooling—Caterpillar has been one of the pioneers in adapting turbocharging to modern diesels, and over 90 percent of all the engines produced by Caterpillar today are turbocharged. The use of aftercooling is an additional step to most effectively use the high performance and efficiency capabilities of turbocharging. The aftercooler is installed between the turbocharger compressor outlet and the engine intake manifold and cools the intake air from 250 to 185° F providing a more dense air charge to the engine cylinders.

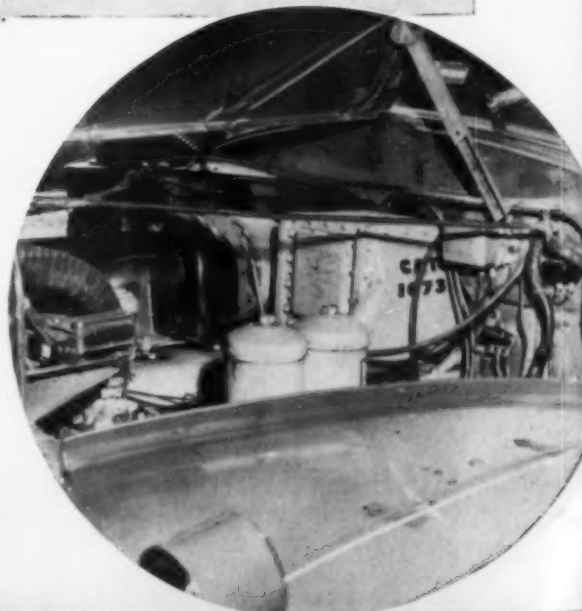
The turbocharger and aftercooler are top mounted on the engine. This arrangement is carefully designed from a flow standpoint, and there is a low pressure drop across the turbocharger-aftercooler-engine intake manifold system which provides for an inherently good flow efficiency. By careful matching of the turbocharging system to engine performance desired in an automotive type application, where engine and turbocharger response in accelerating is important, Caterpillar engineers have provided a favorable air-fuel ratio over the full operating range to insure clean burning of the fuel and good engine response to acceleration. The aftercooler, which uses jacket water as the cooling medium, is a plate type unit. The turbocharger is a four in. Schwitzer high output unit with pressure ratio of approx. 2:1.

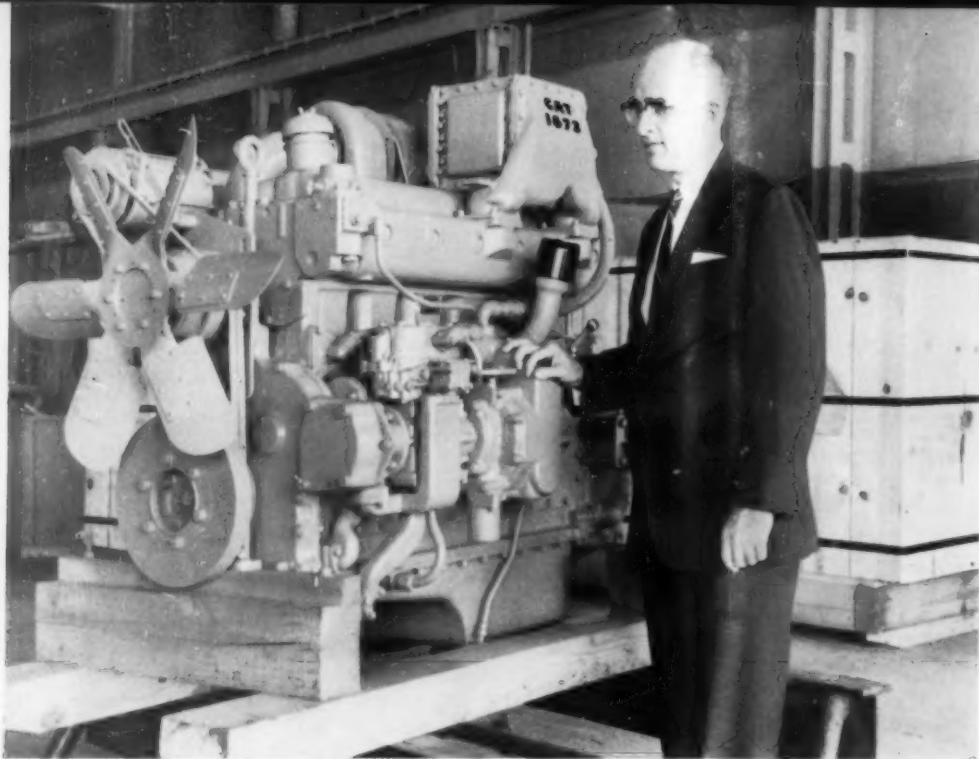
Turbocharging of diesel engines is recognized as one of the most advantageous ways to improve engine efficiency and output when properly matched and designed into the engine. Turbocharger design has improved very significantly in



Greco Excavating Co. of Rosemont, Ill. repowered this Mack B-63 truck with the Cat 1673 engine. Truck averages 48 to 60 hrs./week in hauling service. Close-up of the engine installation to right shows ample clearance under hood with top mounted turbocharger and aftercooler.

recent years, and they are very reliable and efficient machines. Caterpillar engineers consider the turbocharger an essential part of their engine because of the benefits it offers in Cat engine design and applications. Extensive laboratory tests show that turbocharging raises the engine bmep, producing more horsepower, while actually reducing the exhaust gas temperature, as compared





Engine Sales Manager Fred Jacobs with the new 220 hp engine. The intercooler shown is a plate type unit using jacket water as cooling medium. Note rigid mounting arrangement on intake manifold.

Engine close-up. A single shaft powered from the timing gear train drives the lube oil pump, BW air compressor and water pump. Attached to the water pump is a plate type Harrison lube oil cooler.

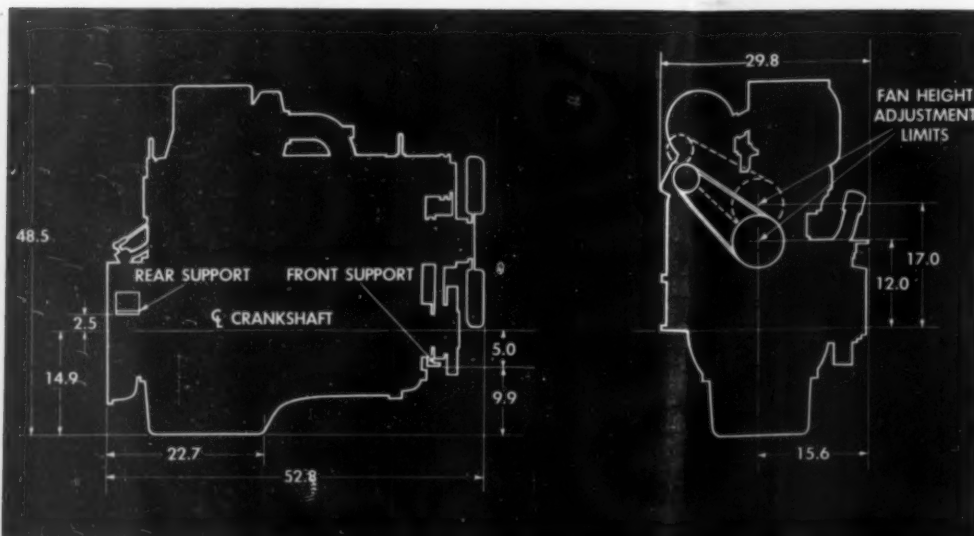
life capabilities and consistent injection performance over its life with no adjustment being possible or required.

Each fuel injection pump (one for each cylinder) delivers fuel to its injector. The system features capsule design of pump delivery mechanism for each cylinder. The accompanying illustration of a cross section of the fuel pump, injector and pre-chamber show the basic simplicity and ruggedness of the system. The fuel injection pump camshaft is gear driven from the accessory drive gear train at the front of the engine, and a fuel transfer pump drives off the same shaft with right angle bevel gear drive. Fuel passes from the transfer pump through a remote mounted fuel filter and then into the fuel injection pump.

Size, Weight and Output. With a displacement of 525 cu. in., the engine produces its healthy

piston with great turbulence, providing good air-fuel mixture and thus complete combustion. During the compression stroke there is lower pressure in the pre-chamber than in the main chamber giving the fuel injector relatively low pressure to inject against. The injector, with a single large orifice has self cleaning properties and offers long

Dimensional diagram of the 220 hp 1673 Caterpillar truck diesel.



220 hp in a compact size. The dimensions are as follows:

Height—48.5 in.

Width—29.8 in.

Length—52.8 in.

The net dry weight of 2070 lbs. is an attractive figure for a heavy duty truck engine. This breaks down to a weight to horsepower ratio of 9.4. The engine has a bmep rating of 152 lbs. per sq. in. Caterpillar engineers report that the engine is conservatively rated to produce long life service in hard working over-the-highway operation. The outline of the engine has been carefully engineered to fit into a wide variety of truck models.

Block and Head. A two wall design is used in the block, which is closely contoured to cylinder shape in low stressed areas to save weight and bulk. Water and intake manifolds are an integral part of cylinder head to further reduce weight. The intake manifold design gives straight-through air flow for good engine breathing. The timing gear train is conventionally located. The camshaft is on left side of engine. Aluminum is used extensively on non-stress parts to also save weight. These include oil pan, timing gear housing, standard SAE No. 2 flywheel housing and valve gear cover.

Cylinders and Piston. There is one intake and one exhaust valve per cylinder and they are of three piece construction with stellite faces. Stellite valve seat inserts and valve rotators are also included. Heat treated wet type cylinder liners with good cooling capabilities are utilized. Pistons are aluminum alloy with reinforced crowns and are cooled with oil jet spray on underside. There are three rings on the piston with the top ring chrome plated and riding in an integrally cast iron insert in the piston to provide long life.

Crankshaft. This is an induction-hardened and shot-peened steel forging with seven main bearings. Bearings are of high load carrying ability aluminum alloy with steel backing. A Houdaille viscous vibration damper is installed on front end.

Cooling system. On the left side of the engine, a gear driven centrifugal pump is built in for circulating jacket water. This pump is driven in tandem behind the lube pump and air compressor drive. Water temperature is thermostatically controlled and an integral by-pass system permits continuous flow of coolant. As an example of radiator sizes for this engine, at the 220 hp rating, Caterpillar recommends a radiator with a frontal area of at least 940 sq. in., core thickness of 3 3/4 in., and 7 fins per inch.

Lubricating system. A positive displacement gear pump assures lubrication to 17 degrees tilt in any direction. A Harrison plate type lube oil cooler is mounted behind the water pump. Full flow lube oil filters are standard and are remote mounted from the engine. The lubricating system requires only twenty-two quarts of oil capacity.

Other accessories included in the basic engine package are Delco-Remy 12 volt, 60 amp alternator and 24 volt starting motor equipped with series-parallel switch, Bendix Westinghouse 12 cfm air compressor, Schwitzer adjustable 6 blade, 26 in. diameter fan and Purolator dry type air cleaner.

UNATTENDED STANDBY POWER PLANTS FOR MISSILE EARLY WARNING SYSTEM

PRESENTLY under construction by the U.S. Army Engineer District, Eastern Ocean for the Ballistic Missile Early Warning System (BMEWS) near Thule, Greenland an automatic-unattended standby power plant comprised of three "power packages" which will, after installation and upon demand, be capable of producing 12,000 kw of power in less than 30 seconds from failure of the prime power source. Purpose of the plant is to maintain, to the maximum extent possible, an uninterrupted beam from each of the four 406 ft. long x 160 ft. high surveillance radar screens installed at the site.

Scanning a range of 3500 miles, yet so sensitive that, after spotting an object thousands of miles away, the radar sets can determine whether it is friend or foe, its trajectory and target, and flash the information to headquarters in a few seconds.

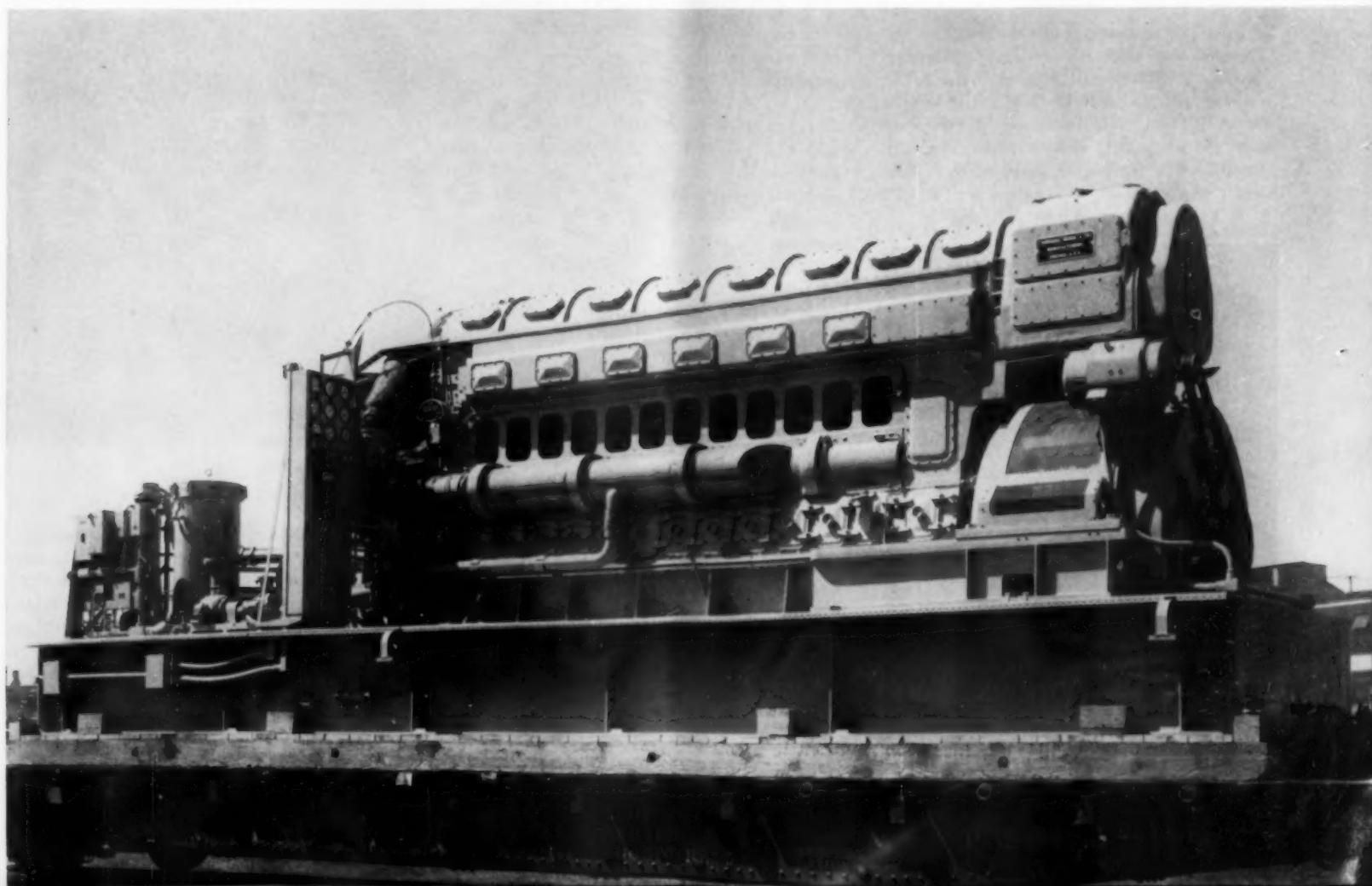
Thule, Greenland is the most northerly point on

the planet where Americans have a permanent Air Force Base—within 900 mi. of the North Pole, 400 mi. closer to the Pole than the northern-most tip of Alaska. Temperatures frequently drop to minus 65 degrees with winds up to 185 mph. Here is our outpost of defense—radar. To be effective, radar must work constantly. To make certain electrical power is available at all times, the U.S. Corps of Engineers, acting as design, construction, and purchasing agents for the U.S. Air Force, provided a prime source of base power with an emergency source immediately available in case of disaster, attack, or accident. This emergency source consists of three completely self-contained, mobile, automatically controlled generating units. Each unit consists of a pair of 2000 kw generators, complete with switchboard and electrical control equipment. Each generator is driven by a Fairbanks-Morse 12-cylinder, 8 $\frac{1}{4}$ in. x 10 in. dual-turbocharged, opposed-piston, model 38D8 $\frac{1}{2}$ diesel operating at a synchronous speed of 720 rpm directly

connected and bracketed to Fairbanks-Morse 2000 kw, 3 phase, 60 cycle, 2400/4160 volt alternators with belted exciters.

Since Thule is "iced in" all but 10 to 12 weeks of the year, delivery of equipment during this ice-free period was absolutely essential. To emphasize the importance of this and the necessity of completion on schedule, the U.S. Army Engineer District applied a severe liquidated damages clause. If the manufacturer failed to make final shipment by the date specified, a penalty of \$300.00 per day per unit would be applied for each day's delay. In addition, the manufacturer would be required to disassemble the unit, crate in sizes suitable for air freight shipment, and pay the Air Force for this air shipment at the rate of \$656.00 per ton of packaged weight plus excess transportation costs incurred by the government in transporting any late delivered items to Air Base from which air shipment would be made after close of ice-free period.

Skid mounted diesel generator set for Thule, Greenland. Set consists of Fairbanks-Morse model 38D8 $\frac{1}{2}$ diesel driving a 2000 kw generator. Engine is equipped with Elliott turbochargers, Woodward governor. Note Nugent lube oil filter.



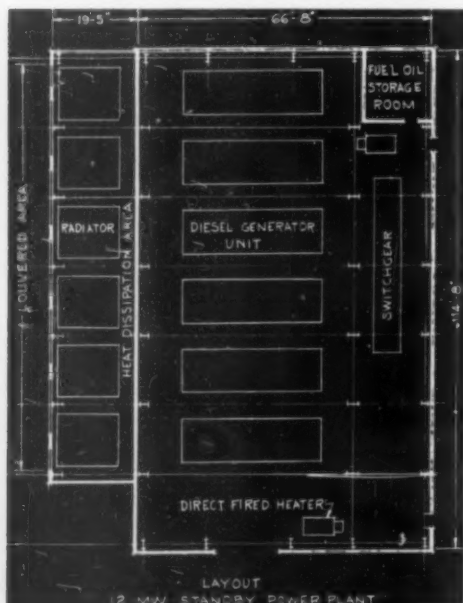


Cold, gray and lonely—the BMEWS installation in Greenland, looking north. Note Wolstenholme glacier in background; here some of the world's largest icebergs are born.

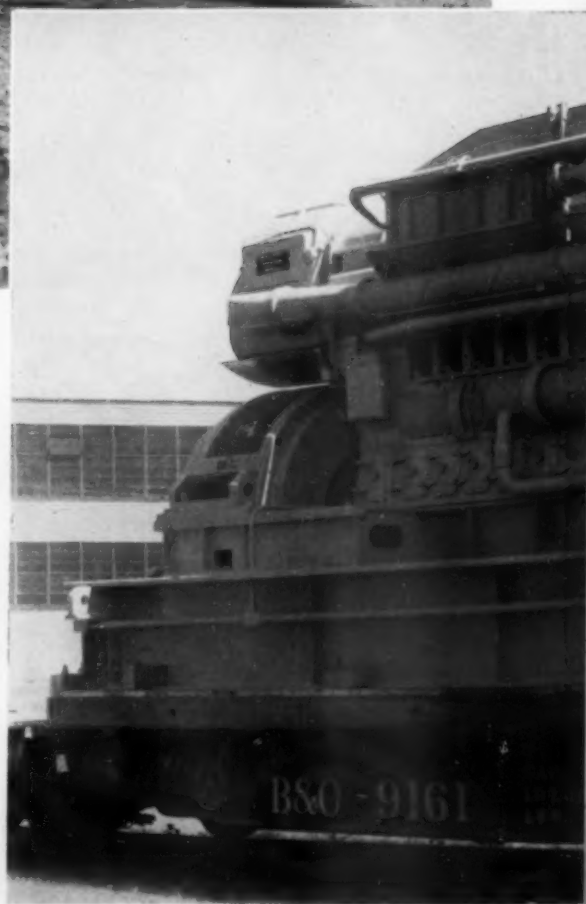
To meet this challenge, Fairbanks-Morse set up a "combat" team of top engineering, design, manufacturing, and managerial personnel. Mr. D. T. Anderson, Staff Engineer-Advanced Diesel Design, was selected as overall coordinator of the entire project. In less than 12 weeks from date of award of contract, the first engine passed its block test. Eight weeks later both units of the first set had

been assembled on skids with generators, auxiliary equipment, and electrical controls, and passed the paralleling and load tests with flying colors.

In order to keep the radar system working constantly, it was required that both generators of each unit start cold on signal, come up to full speed, automatically synchronize, establish stable voltage conditions, and divide the load equally, picking up a full load of 4000 kw within 30 seconds. To insure positive, instantaneous starting at all times, the mass of the units will be continuously maintained at approx. 140° F. while in the stand-by condition by electric immersion heaters in the coolant system together with small capacity circulating pumps, thermostatically controlled. The units are skid mounted, factory assembled, complete with wiring and piping including lube oil strainer and filter, lube oil coolers (2), lube oil and coolant thermostatic control valves, pre-circulating oil pumps (for weekly exercise), stand-by immersion heater and circulating pump, and gauge board. Contributing greatly to the fast starting, these engines are equipped with a regular blower which operates in series with twin Elliott turbochargers. As the load builds up, the turbochargers



Sketch of standby power plant layout.



take over intake air supply and the blower. The turbochargers, blower, and lube oil and coolant pumps of course, are also an integral part of the units. The skid mounted assembly totaling 114,000 lbs. was shipped as a complete single unit and will be installed as such. Installation at the site will consist of grouting in the skid units on individual concrete foundations and connection of separate appurtenances such as air cooled radiators, exhaust silencers, switchgear, day tanks, and air

starting system. This method of factory assembly and field installation was employed to reduce high field labor costs and minimize installation time. Further, if so desired at a later date, the equipment of the entire plant can be readily relocated to any other location.

In the plant, the six units will be grouped into three pairs, each pair consisting of a master and slave unit together with their respective automatic starting and synchronizing components. Upon failure of the prime power source all six units will automatically start simultaneously with each slave unit synchronizing to its respective master unit, each pair of units directly connected to individual circuits for proprietary electronic equipment. Upon activation of the plant, it will become attended and, if so desired, pairs of units may be synchronized with each other. It will also be possible to synchronize to the entire prime power network and mandatory upon securing the 12,000 kw plant to preclude interruption of power. Upon

power plant expansion. They can be shuttled for point to point as occasion demands and are constantly ready and available for immediate service, automatically when required.

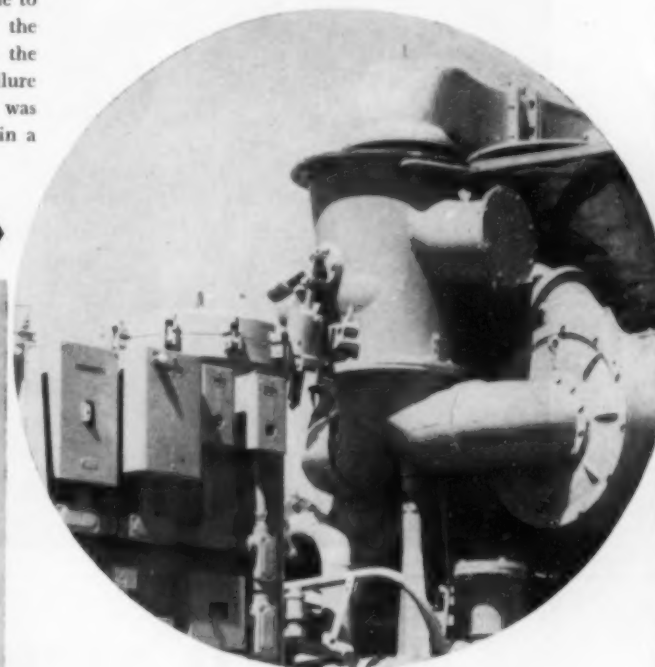
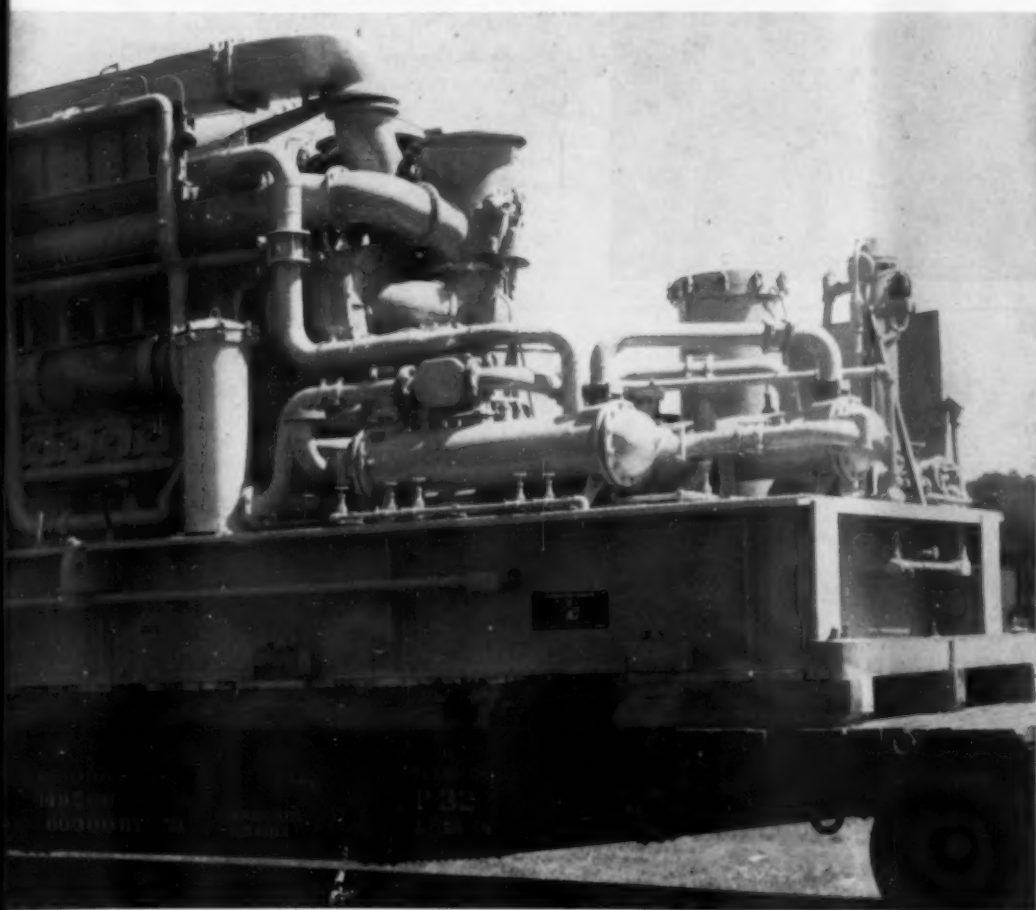
In addition to usual Corps of Engineer requirements for factory load tests and demonstration of both specified frequency and voltage response, each pair of units were required to accomplish four successive successful starts including automatic voltage regulation, synchronizing, and equal load sharing of the 4,000 kw dummy load (resistance banks) within the 30 second requirement from simulated failure of prime power which triggered the automatic components into motion. During the official factory tests the longest elapsed time to accomplish the foregoing was 24.2 seconds; the shortest 15 seconds. During testing prior to the official runs the shortest elapsed time from failure of prime power to equal sharing of full load was 9.2 seconds. All factory tests were completed in a very satisfactory manner.

Coolant system will be protected from the elements (185 mph wind—minus 60 degrees F. temperatures) by ethylene glycol solution. The interior of the plant will be maintained at 50 degrees F. by direct fired hot air heaters. The radiators are located in "lean-tos" and employ two speed motors with reversible fans. The multiple speed together with Amot thermostatic valves will control coolant and lube oil temperatures. The reverse action fans will be used, if required, to remove blow snow blocking the radiator air passages.

Woodward UG 8 governors hold the frequency well within the specification requirements of 0.3 per

Opposite side view of 2000 kw generator set. Note Young intercooler and Ross lube oil cooler.

Closeup of twin Elliott turbocharger installation on Fairbanks-Morse diesel.



cent between one quarter and full load, reestablishing stable engine operating conditions within four seconds following sudden load changes of up to 50 per cent of full rated load. Metal-clad switchgear, voltage regulation, and automatic starting components are by General Electric.

The entire design and construction of the 12 mw plant is under the direct supervision of the U.S. Army Engineer District, Eastern Ocean; architect engineers were Metcalf-Eddy; equipment prime contractor was Fairbanks-Morse & Co. The installation contractor was Greenland Contractors. Using agency is the U.S. Air Force with RCA as designers and operators of the electronic system.

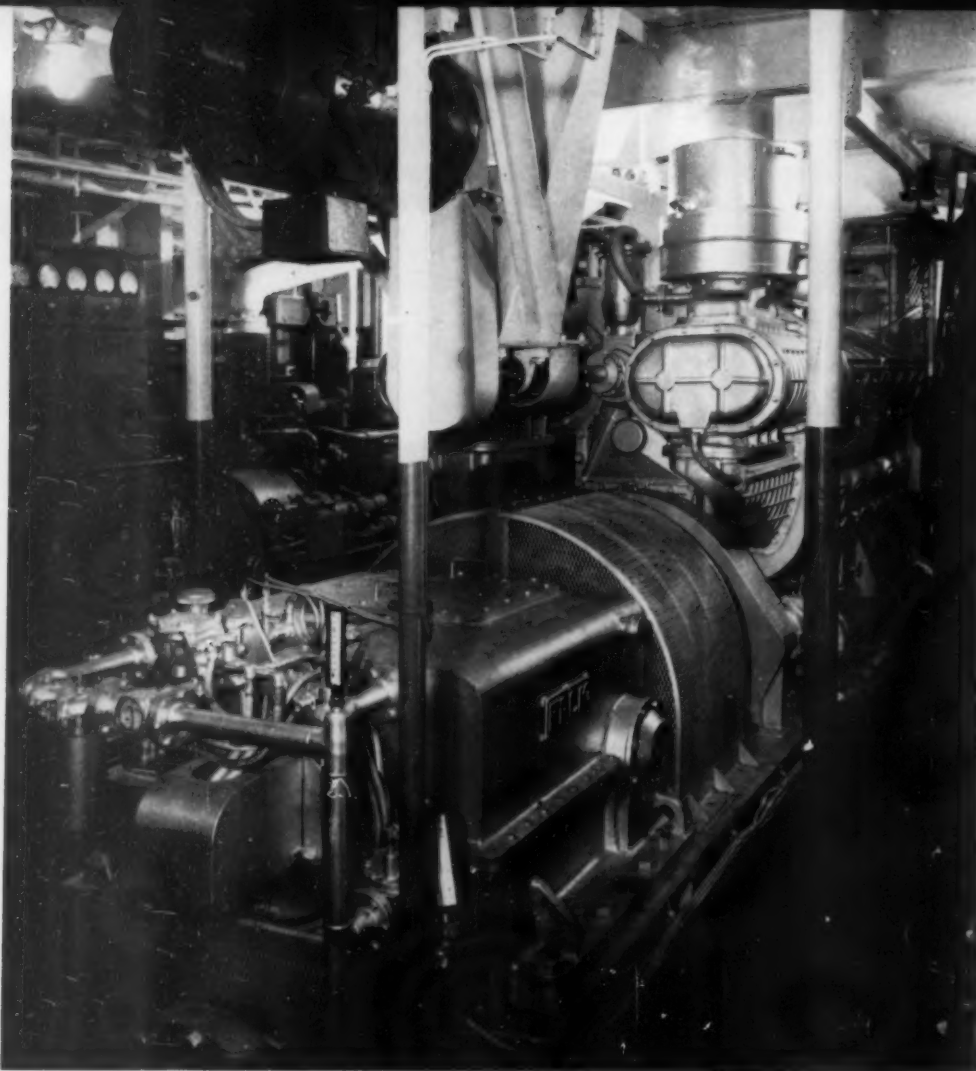
List of Principal Equipment

Engines	Fairbanks-Morse
Alternators	Fairbanks-Morse
Turbochargers	Elliott
Governors	Woodward
Intercoolers	Young
Fuel and lube oil filters	Nugent
Thermostatic controls	Amot
Pre-lube pump	Roper
Lube oil coolers	Ross
Jacket water heater	Wiegand
Switchgear and automatic starting components	General Electric

restoration of prime power the 12,000 kw plant will be secured manually.

The factory tests, conducted by pairs of units, were witnessed by several public utilities who have shown interest in similar units for peaking purposes. These units are ideally suited for this peaking or "back-up" service with utilities and industrial power plants where power demands exceed plant capacity but do not warrant expensive

While in operation the plant will be protected by a safety circuit, which, upon rising coolant temperature above normal or lowering of lube oil pressure below normal, will sound an alarm allowing the malfunction to be corrected. Upon further rise of coolant temperature or falling of lube oil pressure to dangerous levels the units will (separately) be automatically shut down. Automatic shut down will also be initiated by excessive rotational speeds of the engine.



HARBOR TUGS FOR PENN RR

SEVEN new, modern diesel harbor tugboats have gone into service in New York harbor for the Pennsylvania Railroad. They were the first deep water boats built at the Pittsburgh yards of the Dravo Corp., since the end of World War II. After being outfitted the 1230 bhp vessels were towed 1850 mi. down the Ohio and Mississippi Rivers to New Orleans. From that point they proceeded 2000 mi. across the Gulf of Mexico and up the East Coast to New York City.

The new tugs have replaced 12 old PRR tugs: 11 of which were coal fired steam tugs, one an old diesel. Their job is to tow car floats between Pennsylvania Railroad terminals and freight stations and to terminals of other railroads as well as moving lighters and barges loaded with import, export and other traffic for the Pennsylvania. Each of the tugs is identical: 105 ft. long, 26 ft. wide and 13 ft. 8 in. deep and operate at a normal 12 ft. draft.

Propulsion power is supplied by a General Motors (Cleveland Division) model 12-567C diesel engine (8½ x 10 in. bore and stroke) rated 1230 bhp at

Each of the seven new tugboats is similarly equipped with a GM 12-567C, 1230 hp diesel engine driving through a Wichita clutch and Falk reduction gears. 25 kw generator at top of photo is belt-driven off main engine.

TWO NEW TUGS FOR THE NAVY

TWO tugs for use by the U. S. Navy at the Norfolk, (Va.) Naval Base were delivered recently by the Christy Corp., Sturgeon Bay, Wis. The twin tugs are 108 ft. 8¼ in. long, 28 ft. 3 in. at the beam and have a depth of 13 ft. 2 in. Designated the YTB 752 and YTB 753, they are powered by Alco main engines and have GM Detroit Diesel auxiliary generator sets.

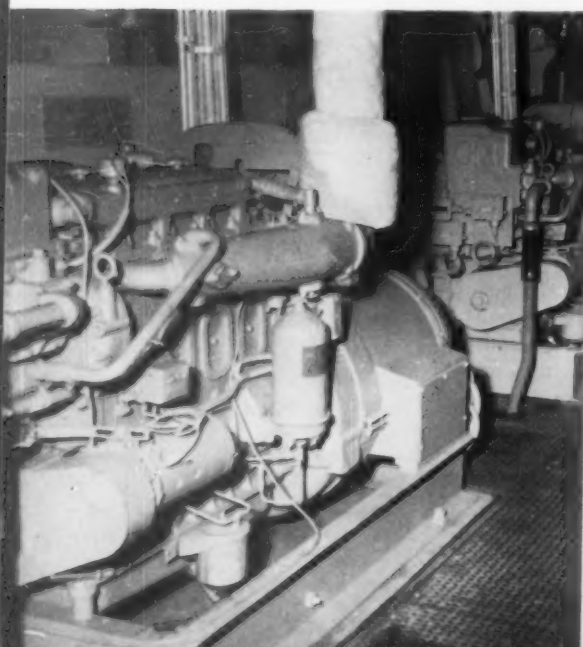
The YTB 752 was delivered to Norfolk by way of the Mississippi River and New Orleans. The craft was floated down the Mississippi on pontoons which were removed at New Orleans. The tug then proceeded to Norfolk under its own power. The YTB 753 made the trip from Sturgeon Bay to Norfolk under its own power via the St. Lawrence Seaway.

The model 251B Alco engine drives through a Falk Airflex coupling and Western Gear horizontal offset reduction gear. The main engine is a 12 cylinder turbocharged and aftercooled model with 9 x 10½ in. bore and stroke and rated 1800 bhp at 1000 rpm. Driving at 1000 rpm through the 5.5:1 reduction gear, the engine turns a Liaen-Wegner controllable pitch propeller at 180 rpm. The main engine also drives a DeLaval main fire pump through a Western Gear speed increaser coupled through an air actuated Wichita Clutch.

Main engine cooling is through a single-pass, shell

and tube, Young jacket water heat exchanger. Lube oil cooling is also through a Young single-pass shell and tube heat exchanger.

The tugs turned in a speed of over 14 knots in their trials. Bollard pull was rated at over 45,000 lbs. Ship's electrical service is supplied by two GM model 4044B diesel generating sets rated 40 kw.



Two GM model 4044B diesel generator sets provide auxiliary electric power for the YTB's.

YTB 752 on her trial trip before delivery to the Navy.



DIESEL AND GAS ENGINE PROGRESS

Tug *Cincinnati* during trial runs on the Ohio River before delivery to the Pennsylvania Railroad at New York.

800 rpm. The engine drives through a Wichita clutch and Falk HMBW reverse-reduction gear. Starting air is from an Ingersoll-Rand compressor.

Auxiliary electric power is provided by a 25 kw Safety Industries generator belt-driven off the main engine, and from two GM Detroit model 4064B diesel engines driving Delco Products 40 kw generators. The latter engines are rated 80 hp at the 1200 rpm governed speed.

Pennsylvania Railroad officials said the new tugs will permit improvement in service to shippers by increasing overall efficiency of harbor operations and speeding movement of car floats in the harbor area. Pennsylvania's New York harbor fleet includes 19 diesel and four oil-fired steam tugs.

Principal Equipment

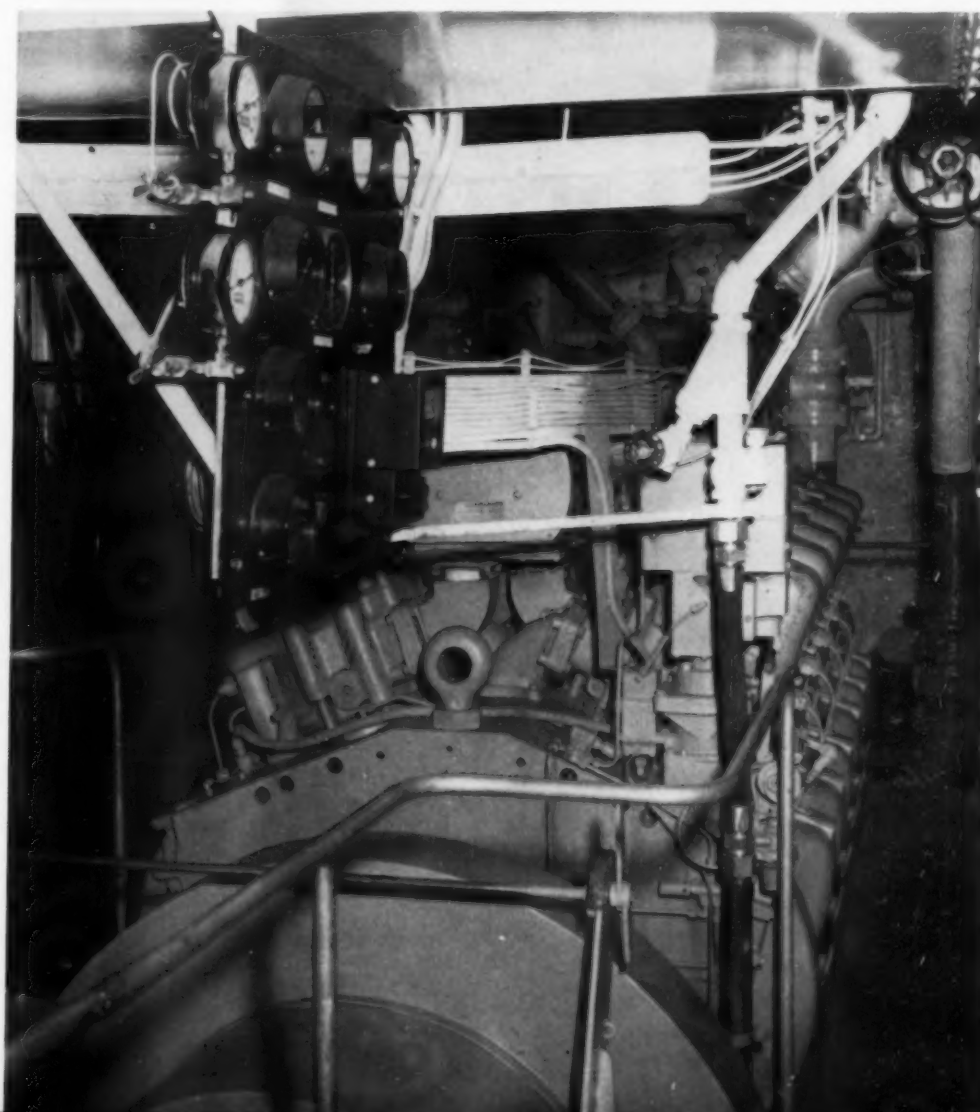
Main Engine	GM Cleveland
Governor	Marquette
Air Compressor	Ingersoll-Rand
Clutch	Wichita
Reverse-reduction gear	Falk
Fuel oil transfer pump	Gould
Lube oil filter	Briggs
Lube oil strainer	Cuno
Lube oil, cooling water heat exchangers	Ross
Thermostatic controls	Fulton-Sylphon
Exhaust muffler	Maxim
Auxiliary generator sets	GM Detroit

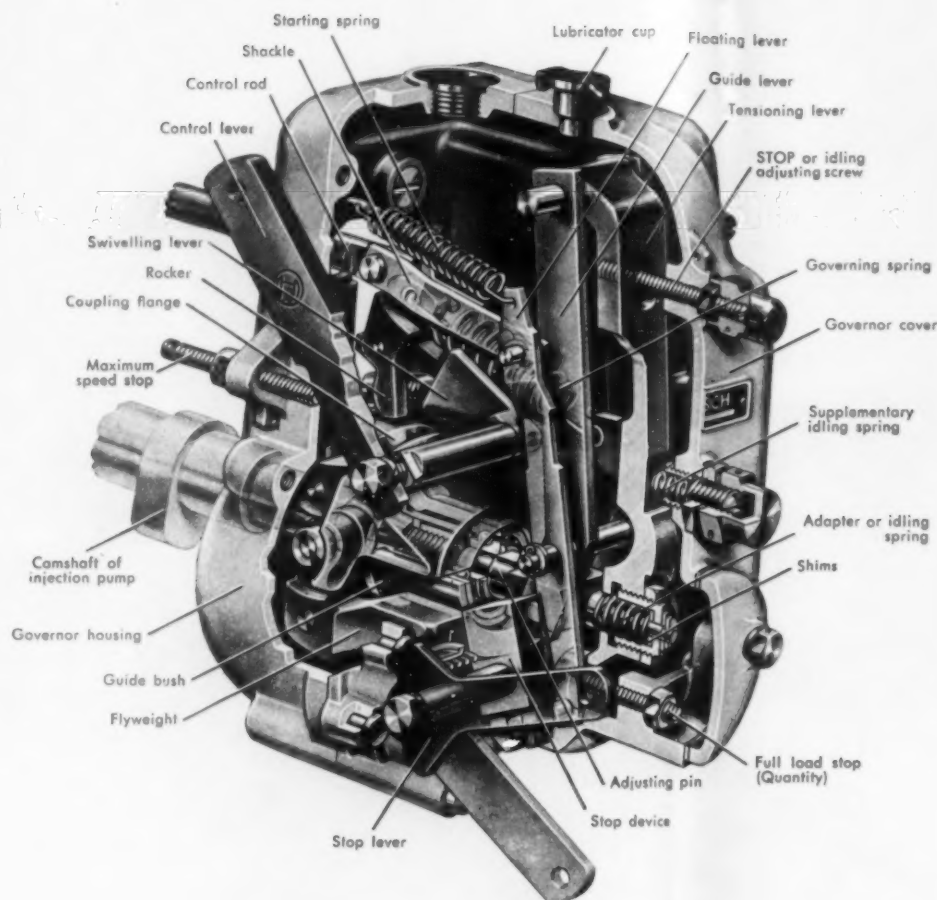


Engine room looking forward. Alco model 251B diesel engine, rated 1800 hp at 1000 rpm drives propeller through Falk clutch and reverse-reduction gear.

Principal Equipment

Main Engine	Alco
Governor	Woodward
Jacket water, lube oil heat exchangers	Young
Temperature control valve	Amot
Reduction gear speed increaser	Western
Fire pump clutch	Wichita
CP propeller	Liaen-Wegner
Starting air compressors	Ingersoll-Rand
Auxiliary generating sets	GM Detroit





Schematic cross section of the Robert Bosch RSV governor. An RSUV type is also built for controlling very low engine speeds, such as those encountered on marine engines. Unlike the RSV, this governor has step-up gearing built-in between the driving camshaft of the pump and the governor coupling flange.

ulates a change of the effective spring rate in accordance with the centrifugal force on the flyweights which increases as the square of speed. In this way the governor provides an essentially constant number of rpm overrun between full load and no load at any engine speed between minimum and maximum torque.

In the design of the RSV, Robert Bosch has come up with a governor which can be applied to the large variety of fuel injection pumps which they manufacture and at the same time, they have achieved a great degree of standardization. The accent on standardization was the result not only of a desire to keep manufacturing cost to a minimum by allowing full automation of component parts fabrication, but also to simplify service parts stock in the field.

Extensive experiments and experience have shown that diesel engines will start at a lower temperature if the starting fuel quantity is considerably in excess of the full load quantity. The RSV governor contains an auxiliary starting spring which moves the control rack to the starting fuel quantity position when the engine is stopped. By the time engine speed is up to low idle rpm

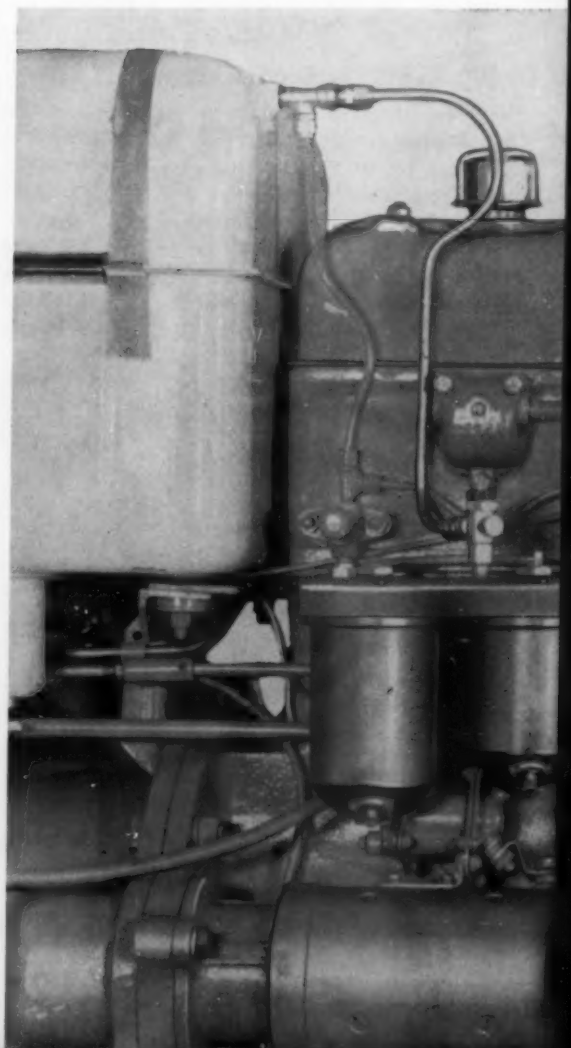
MULTI-APPLICATION RSV VARIABLE SPEED GOVERNOR

**New Robert Bosch Unit for High Speed Diesels Has
Range of Application Yet Achieves Marked
Degree of Parts Standardization**

DEVELOPMENT of governors for high speed diesel service have been fairly pronounced recently as the application range of these engines is constantly broadened. Focusing on this, Robert Bosch has fully developed and is now actively marketing a new centrifugal variable range speed governor for multi-purpose diesel engines. Designated the model RSV, the new governor provides a control range and degree of irregularity that can be varied easily and quickly.

Variable speed governors provide essentially constant speed within the range of the value of regulation, between full load and no load for any

basic engine speed, as established by the position of the governor control lever. In its program, Robert Bosch has produced a variable speed centrifugally operated flyweight device with the force of the flyweights balanced by one governing spring. This main spring is actuated by the governor control lever to increase tension for high engine speed and to decrease tension for low engine speed, and the way it operates is one important feature of the RSV governor's performance. As the main governor spring tension is increased its angular relationship to the tensioning lever changes and thereby the percent regulation changes as a function of engine speed. This sim-

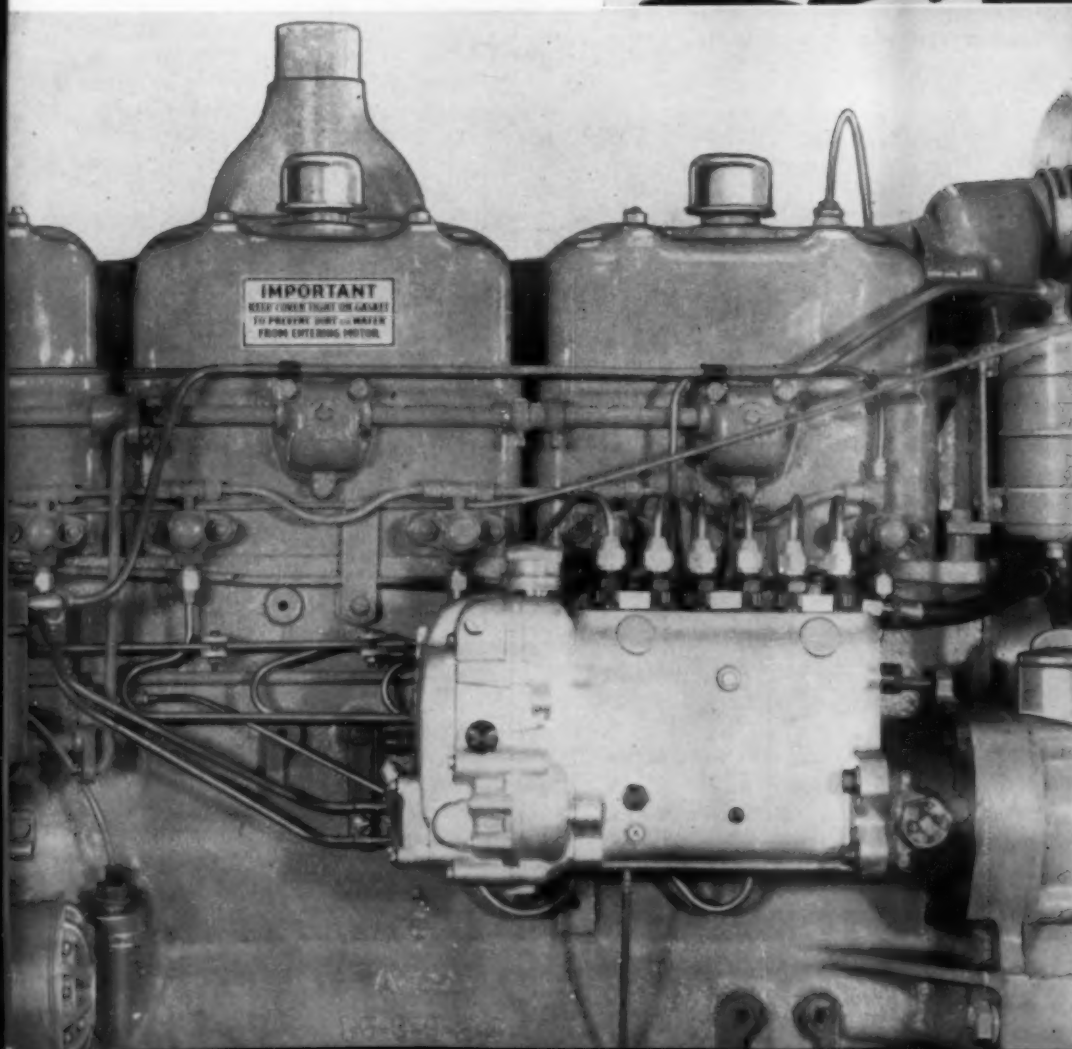
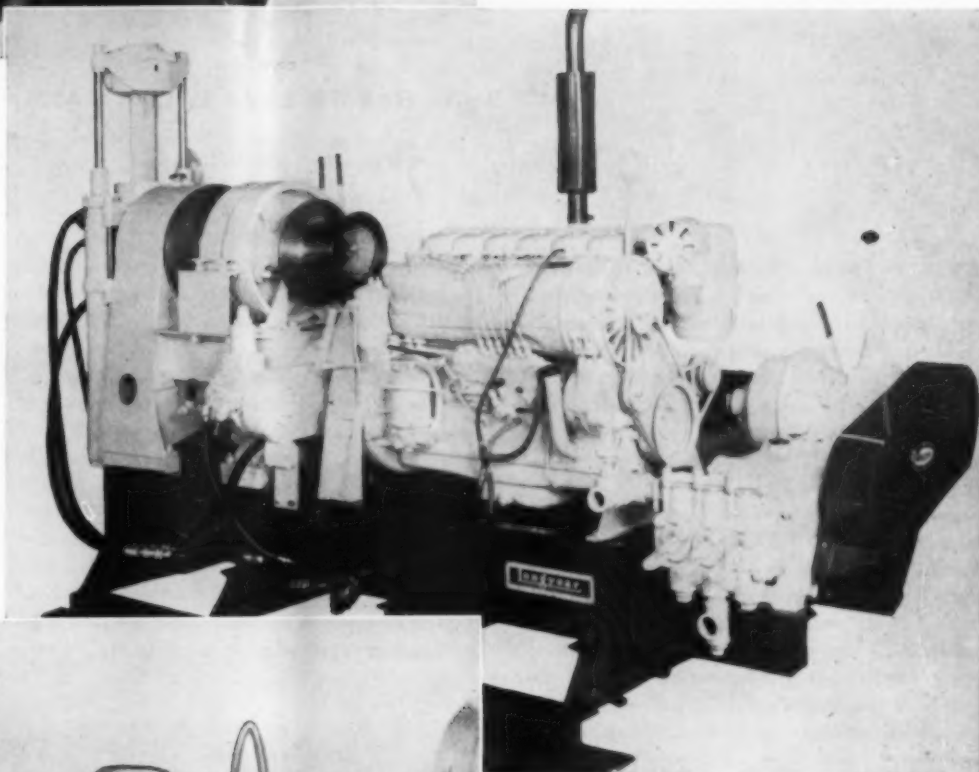




Adaptability of the RSV governor is illustrated on this 55 hp Mercedes-Benz diesel. This powers one of 100 new taxis recently placed in service by Yellow Cab Co. in Los Angeles.

Another application of the Robert Bosch RSV governor and pump is shown on this F6L 712 Deutz air-cooled diesel powering a diamond core drill. The 312 cu. in. engine is rated 66 hp at 2300 rpm.

Case 930 Powrcel tractor diesel with 401 cu. in. displacement uses a Robert Bosch PES 6A injection pump with RSV governor as shown.



the starting spring is overridden and the control rack position is established by the flyweights in the normal manner. This device is automatic and fully enclosed so that excess fuel cannot be obtained manually, thereby protecting the engine from tampering (willful overloading).

The RSV governor incorporates a torque control system whereby the natural fuel delivery curve at fixed rack is utilized to obtain an increase in torque from low speed up to the point where engine volumetric efficiency is best, and as the volumetric efficiency curve decreases with increasing engine speed the fuel quantity is automatically reduced at a controlled rate to full load at maxi-

mum speed. This is accomplished by a torque capsule containing a torque spring set at a determined pretension. The torque control spring begins to compress at the desired peak engine torque position and its spring rate determines the slope of the maximum fuel delivery curve which corresponds to the maximum torque curve.

The design incorporates a means for adjusting percent regulation externally. A set screw is provided by which the position of an adjustable rocker bracket, to which the main governor spring is connected, may be changed. Other characteristics of the governor particularly those for smooth idling and maximum speed may be adjusted externally. These adjustments are made accessible so that the engines may be adjusted in the field in accordance with the altitude at which they operate. A reduction in fuel delivery of about 3 percent per 1000 ft. of altitude above sea level is desirable as atmospheric air density decreases at high altitude. These adjustments may be made easily, but the adjusting screws are provided with seals to prevent unauthorized tampering.

GAS TURBINE CYCLES AND DESIGN CONCEPTS FOR VEHICLE PROPULSION

A Discussion of Gas Turbine Design Showing How Load and Its Characteristics Can Affect Design and Suggestions on Another Approach to the Vehicle Propulsion Problem Including Integration of A Simple Gas Turbine With a Diesel Engine For An Efficient, Versatile and Compact Power Plant

By C. H. PAUL and E. L. KUMM*

THE past ten years have witnessed an intensification of the effort to apply gas turbine power plants to propel vehicles, and at times it appears that the proper perspective for this application has not always been kept in sight. Many papers have been written about the economic requirements of low cost and low specific fuel consumption—two of the main problems confronting the gas turbine designer. However, most of these discussions concern themselves primarily with the fuel consumption at full-load conditions without adequately attempting to define the problem areas at part load and/or part speed. This report is concerned, in part, with showing how the load and its characteristics can affect the gas turbine design, and, in part, with suggesting another approach to the vehicle propulsion problem. Gas turbines designed for propelling vehicles have characteristically used comparatively low compressor pressure ratios (3.5 and less), together with regenerative heat exchangers between the turbine exhaust gases and compressor discharge air,

Let us examine the cycle performance of the gas turbine with and without regeneration and associated pressure losses to determine the significance of changing the design compressor pressure ratio. The manner in which the specific fuel consumption (sfc) is decreased with an increase in turbine inlet temperature for a simple, open-cycle, shaft-power gas turbine is well known, as shown in Fig. 1. The minimum sfc is obtained at high compressor pressure ratios. Using a heat exchanger to exchange heat between the turbine exhaust gases and the compressor discharge air results in shifting the location of the minimum sfc for a specified turbine inlet temperature to lower compressor pressure

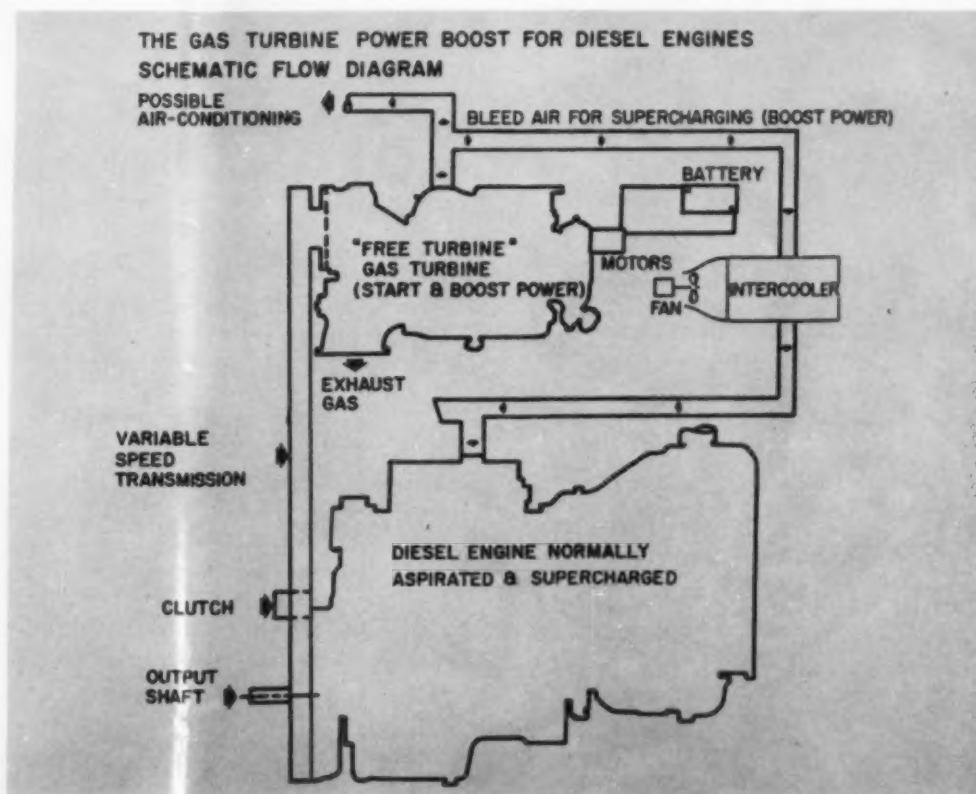
ratios (Fig. 1). However, the sfc is dependent on the pressure losses in the regenerator or recuperator in a critical fashion.

Fig. 2 shows the manner in which it is expected that the sfc would increase with heat exchanger pressure losses in a typical case. A turbine inlet temperature to compressor inlet temperature ratio of 4.0 was used in this comparison. With a 60 F compressor inlet temperature, this gives 1620 F turbine inlet temperature. A regenerated gas turbine using a low compressor pressure ratio for full-load design point is observed to be much more sensitive to pressure losses at part-load condition than a regenerated gas turbine using a higher design, full-

load compressor pressure ratio. Increased pressure losses can result from dirt and carbon deposits in recuperator or regenerator passages during operation as well as from enclosed installations having larger than normal inlet and exit duct losses.

Speed Control Functions

For any particular gas turbine, the sfc will also depend on the type of speed control, as may be seen most easily from a typical compressor map (Fig. 3). As shown on this map, it appears that a control which will let the gas generator speed float with output load (that is, maximum load=maximum speed; lower load = lower speed) while maintain-

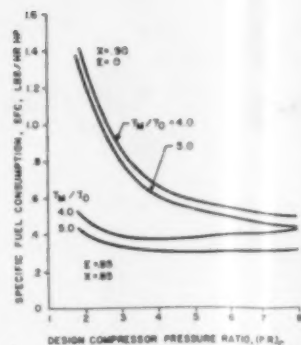


*This paper by C. H. Paul and E. L. Kumm, Assistant Chief Engineer and Engineering Specialist respectively for the AiResearch Mfg. Co. of Arizona, Div. of Garrett Corp., was presented at the SAE National West Coast Meeting, Aug. 1960, San Francisco, Calif.

ing as nearly a maximum turbine inlet temperature as possible would be desirable. A constant speed control permits a single-shaft gas turbine to accept large, rapid, load changes without stalling, but is inefficient at part-load operation. A variable speed control is efficient, operating at nearly a constant inlet turbine temperature, but such a control will not accept large, rapid load changes in the direct-drive, single-shaft gas turbine. The well-known "free turbine" gas turbine which eliminates the mechanical connection between the output power shaft and the "gasifier" power unit is one approach to solving this problem. Fig. 3 indicates another fuel consumption compromise associated with gas turbines—namely, the dependence of the idle fuel consumption on the magnitude and the rapidity of the load change possible to accept at idling speed. The idle speed and subsequent fuel consumption may be decreased at a sacrifice in the rate of possible change in load at the idle operating point.

In Fig. 4, the specific fuel consumption is given as a function of the per cent of design shaft horsepower and the per cent of design characteristic speed. In essence, this is a replot of the previous maps showing the actual values of sfc utilizing the variable speed control mentioned previously. Thus, it is observed that although the sfc of the gas turbine having a design compressor pressure ratio of 4.5 is lower at full load than a gas turbine having a design compressor pressure ratio of 6.25, the part-load sfc is greater at loads less than 65% of maximum load. The resulting calculated part-load fuel consumption of a 200-hp regenerated gas turbine having two design full-load compressor pressure ratios is given in Fig. 5. An optimum-fuel-consumption, variable speed control was assumed. Another major consideration in the choice of the design full-load compressor pressure ratio is the physical size and weight of the gas turbine to produce a required horsepower. Fig. 6 gives the horsepower per pound per second air flow as a function of the effective pressure ratio fraction and compressor pressure ratio. The increased size and weight of the gas turbine using a lower design compressor pressure ratio must also be taken into account in making the selection of a design full-load compressor pressure ratio.

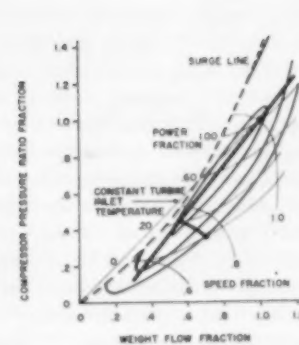
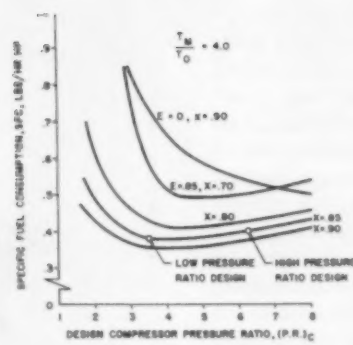
The question of whether to use a recuperative heat exchanger or a rotary regenerator depends on the state of the art as much as anything else. With improvements in production techniques using thinner gage materials, it appears theoretically that recuperative heat exchangers can be made as light in weight for the same overall performance as rotating regenerators with their associated seals and leakage. This is particularly true at lower values of heat exchanger effectiveness such as $E=0.6$ where simple, cross-flow heat exchangers can be utilized. The lower heat exchanger effectiveness values have maximum thermal efficiencies or minimum specific fuel consumptions shifted to higher design compressor pressure ratios, as shown in Fig. 7. When the heat exchanger weight increase associated with an increase in the heat exchanger effectiveness is considered (Fig. 8), one's enthusiasm for a maximum heat exchanger effectiveness may be seriously abated by the accompanying weight and volume penalties, and a desire for a reasonable compromise appears. Such a compromise favors the initial



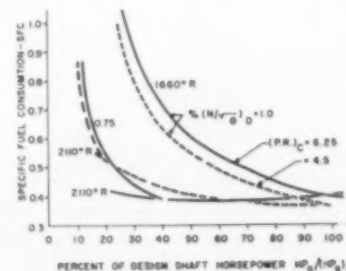
(Fig. 1) Generalized gas turbine performance
 X = Effective Pressure Ratio Fraction
 E = Heat Exchanger Effectiveness
 $(E=0, \text{ no heat exchanger})$
 0.85 = Compressor Polytypic Efficiency
 0.87 = Turbine Polytypic Efficiency

(Fig. 2, center) Gas turbine design performance with heat exchanger pressure losses
 X = Effective Pressure Ratio Fraction
 E = Heat Exchanger Effectiveness
 $(E=0, \text{ no heat exchanger})$
 0.85 = Compressor Polytypic Efficiency
 0.87 = Turbine Polytypic Efficiency

(Fig. 4) Gas turbine fuel consumption as related to load and speed
 X = Effective Pressure Ratio Fraction = 0.85
 E = Heat Exchanger Effectiveness = 0.85
 0.85 = Compressor Polytypic Efficiency
 0.87 = Turbine Polytypic Efficiency



(Fig. 3) Gas turbine performance as related to the compressor characteristics
 $\text{Compressor Pressure Ratio Fraction} = \frac{(P.R.)_c - 1}{(P.R.)_c - 1}$
 D
 $\text{Weight Flow Fraction} = \frac{W \sqrt{\theta}}{\delta} / \left\{ \frac{W \sqrt{\theta}}{\delta} \right\} D$
 $\text{Speed Fraction} = \frac{N}{\sqrt{\theta}} / \left\{ \frac{N}{\sqrt{\theta}} \right\} D$



choice of a comparatively high design full-load compressor pressure ratio which can operate reasonably efficiently by itself, or can also benefit materially from the incorporation of easily cleaned, simple heat exchangers. Thus, a wide range of applications may be served by a high design compressor pressure ratio gas turbine engine which may be utilized in both a regenerated and a nonregenerated fashion. However, the desirability of the lower fuel consumption associated with the additional weight and volume of a recuperator depends basically on the load versus time characteristic of the application. For some specialized applications it even appears that a new approach might well be considered for vehicle propulsion whereby minimum specific fuel consumption can be achieved while utilizing the design advantages of a simple-cycle gas turbine.

In Combination With Diesel

One that appears to give many attractive features consists of integrating the simple, nonregenerated gas turbine with a diesel engine. At first thought, such an idea sounds mechanically complicated and perhaps not worthy of the effort. But if one takes the time to reconsider, it becomes apparent that such an integration results in an efficient, versatile,

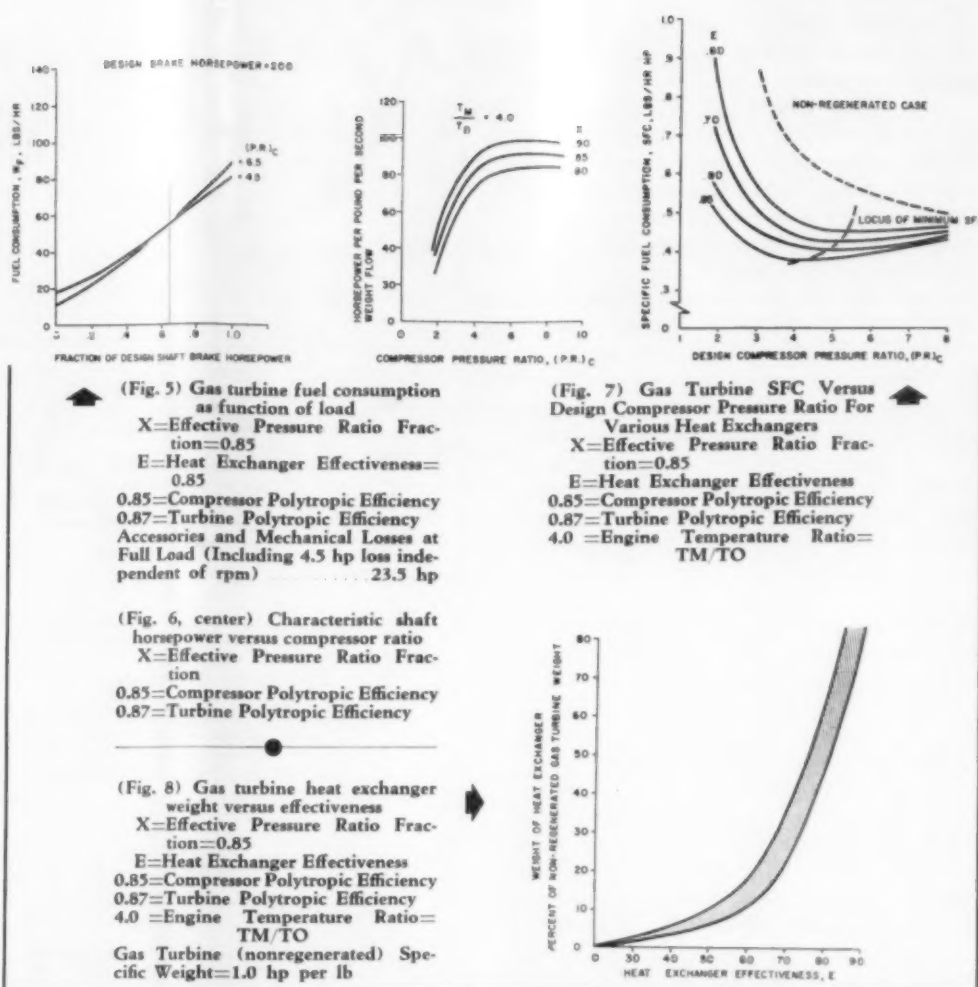
lightweight, compact powerplant. Fig. 9 illustrates the proposed concept of a dual powerplant. The gas turbine is used to supply the starting power for the diesel engine. At very low subzero temperatures, the gas turbine supplies hot gases to preheat the diesel engine and its fuel and then start it. The gas turbine can, of course, be started at very low temperatures with comparative ease, either electrically (using nickel-cadmium batteries, for instance) or by using other available starting techniques such as handstarting.

The diesel engine can then be used efficiently over its lower power range in a normally aspirated fashion, with the gas turbine not operating and declutched from the drive shaft. Additional power demands can be met by both clutching in the gas turbine to the drive shaft and using the gas turbine to supply pressurized air to the diesel engine (supercharging the diesel). With such operation, the output power may be increased in a major fashion. Table 1 shows the wide power variation possible in such a combination by varying the gas turbine speed. A variable-speed transmission would permit operating the output drive at various speeds with respect to the gas turbine speed. The variable-speed transmission could be eliminated by

using the gas turbine for bleed air only. The gas turbine/diesel engine combination offers many other advantages besides low temperature starting—good fuel economy over a very large power range, small physical size, and low weight. The gas turbine may be operated with a wide range of fuels, and since the turbine is available for starting the diesel, the reciprocating engine can accept a much wider range of multifuel usage. The gas turbine bleed air can also be used for air conditioning purposes or for heating purposes. Air conditioning is becoming a necessary incorporation in advanced, large power equipment for improving operator comfort and increasing the utilization time of the equipment. The bleed air can be used for comfort heating directly, and large quantities of hot exhaust gas or bleed air are available to melt snow and ice. In addition, the gas turbine is an additional or emergency power source, giving dual engine reliability to a vehicle.

TABLE 1—Using Gas Turbine To Boost Diesel Engine Power

Diesel Output		Gas Turbine		Total Vehicle	
Air Charge	Bmep, psi	Per 4-Cyl Bhp	Bleed Airflow, Bhp Lb/min	Bhp	Req.
Natural Aspiration	100	37.5	150	0	0
Low P/R Turbo	200	75	300	0	45
Inter P/R Turbo	250	95	375	125	55
High P/R Turbo	300	112.5	450	200	65



3-R'S DEPEND ON DIESEL GENERATORS

CONSIDERING the extent to which mainline electric power has been made available in almost all communities of America, power generated by any other means today is certainly unique and is generally confined to only the most remote areas of the country.

One example, however, is to be found in the badlands of northwest New Mexico, where much use continues to be made of individual power-producing plants to meet the needs for electrical current. There the terrain is the toughest to be found anywhere and the widely scattered inhabitants are mostly Indian settlers.

While life for the older residents of the area requires little more than the basic needs, a simple log dwelling and a patch of farm land, the children of these settlers appear headed for better things through education. But this requires schools which in turn require adequate electric power.

As the local power authority moves rapidly to extend complete services to the area, the people and their leaders continue to rely on diesel-driven generator sets as a power source for schools and other similar institutions.

Two GM 6-71 diesels drive Delco generators at the Sanostee school. The generator sets have recorded over 50,000 hrs. since 1954. Note Lubri-finer lube oil filters.

Typical of the use to which these diesel generators are put is the Sanostee boarding and day school near Farmington, N. M., where some 200 Indian youngsters attend school daily. Power for the entire school including living quarters for resident students is provided by two high-capacity generators powered by GM Diesel 6-71 engines. The first of these units was put into service in 1954 and has performed impressively, recording 22,000 hours before overhaul became necessary in 1958. The second unit has worked 23,000 hours with no overhaul as yet. The generator sets operate alternately for 500 hrs. each unless parallel hookup

of both becomes necessary to meet exceedingly heavy demands. Requirements include current to operate furnace stokers, heat water for heating plant, lights, refrigerators, walk-in freezer, cooking facilities, dish washer and other utilities.

The school sponsored by the Department of Interior—Bureau of Indian Affairs—is attended by children six to twelve years from homes in a 10 mi. radius of the school. Believing proper environment is important to education, the school lifts children of the area from primitive dwellings and a simple way of life into modern living quarters.





M/V JAMES R. HINES

By LOUIS M. REITZ

NOW operating in the oil trade on the Ohio River and its tributaries is the new towboat *James R. Hines*, named for the father of Capt. James G. Hines, president of Hines, Inc. of Bowling Green, Ky. Built on the ways of the St. Louis Shipbuilding & Steel Co., the 110 ft., 1800 hp vessel measures 28 ft. in the beam x 10 ft. with a normal draft of 7½ ft.

A rather unusual after end design employing modified tunnels with St. Louis Ship's tank tested contours and well rounded knuckles permits use of 78 in. wheels of special St. Louis design. Capt. Hines explained this combination makes it possible to run her at her "normal draft," which will be handy when negotiating shallow tributaries. This specially designed after end efficiently utilizes the total 1800 hp (at 744 rpm) of the two GM 12-567A Cleveland marine diesels turning the wheels at 252 rpm through Falk Airflex clutches and reverse-reduction gears with a ratio of 2.98:1. The high tensile (SAE 4340) forged steel shafts turn in Goodrich rubber and centrifugally cast bronze bushings mounted in the stern tubes which are braced by "V" struts. The two steering and four backing rudders are actuated by St. Louis Ship hydraulic controls with mechanical follow-up.

The well lighted and ventilated engine room is lined with a sound absorbing acoustical material painted white. Removable guard rails and double engine doors on each side make it possible to effect major engine repairs using lifts riding on the overhead trolleys. Exhaust headers lead from the engines to Burgess-Manning exhaust silencers installed in "stack" or shrouds on the "boiler deck" overhead.

Forward on the starboard side are two Caterpillar D318 60 kw diesel-generator sets which turn at 1200 rpm. These are 4 cycle engines with 6 cylinders each of 4½ in. bore and 5½ in.

stroke. The switchboard has panels for 110 and 220 volts circuits with machines hooked up for parallel operation.

Operated from the pilot house, the Westinghouse Air Brake engine control systems have throttle and clutch interlock. Engines are cooled by a St. Louis Ship designed closed, clear water skin cooling system welded to the sides of hull where it is least liable to damage should the bottom drag over a "catfish", as the lumps on the bottom

Modified tunnels, specially designed propellers aid handling in shallow tributaries.

Starboard main engine. Propulsion is provided by a pair of these units, GM model 12-567A, rated 900 hp each at 744 rpm. In the background is pair of Caterpillar D318, 60 kw diesel generator sets.



Towboat *James R. Hines* has special modified tunnel after end design, skin cooling system welded to sides to ease operations in shallow waters.

in a shoal place are often called. Two Quincy 5 hp, 23.5 cfm air compressors, one a standby, are used for the steering system. Engines have Ingersoll-Rand air starters.

The *James R. Hines* has a model scow bow. The hull is heavily framed transversely and longitudinally and has ¾ in. sides and bottom with ½ in. plate at bilges and other impact and wear points. The ⅝ in. deck plate is increased to ⅞ in. in the engine room pit. Bulkheads both longitudinal and transverse are ¾ in. thick with vertical and horizontal stiffening.

Principal Equipment Serving GM Cleveland Engines

R & R gear, clutch	Falk
Governors	Marquette
Air Compressors	Quincy, Ingersoll-Rand
Engine control	Westinghouse Air Brake
Lube oil filter	CFC Fullflo
Lube oil strainer	Purolator
Lube oil reclaim	Winslow
Lube oil cooler	Ross
Thermostatic control	Amot
Exhaust silencers	Burgess-Manning



NEW FORD INDUSTRIAL DIESEL ENGINE

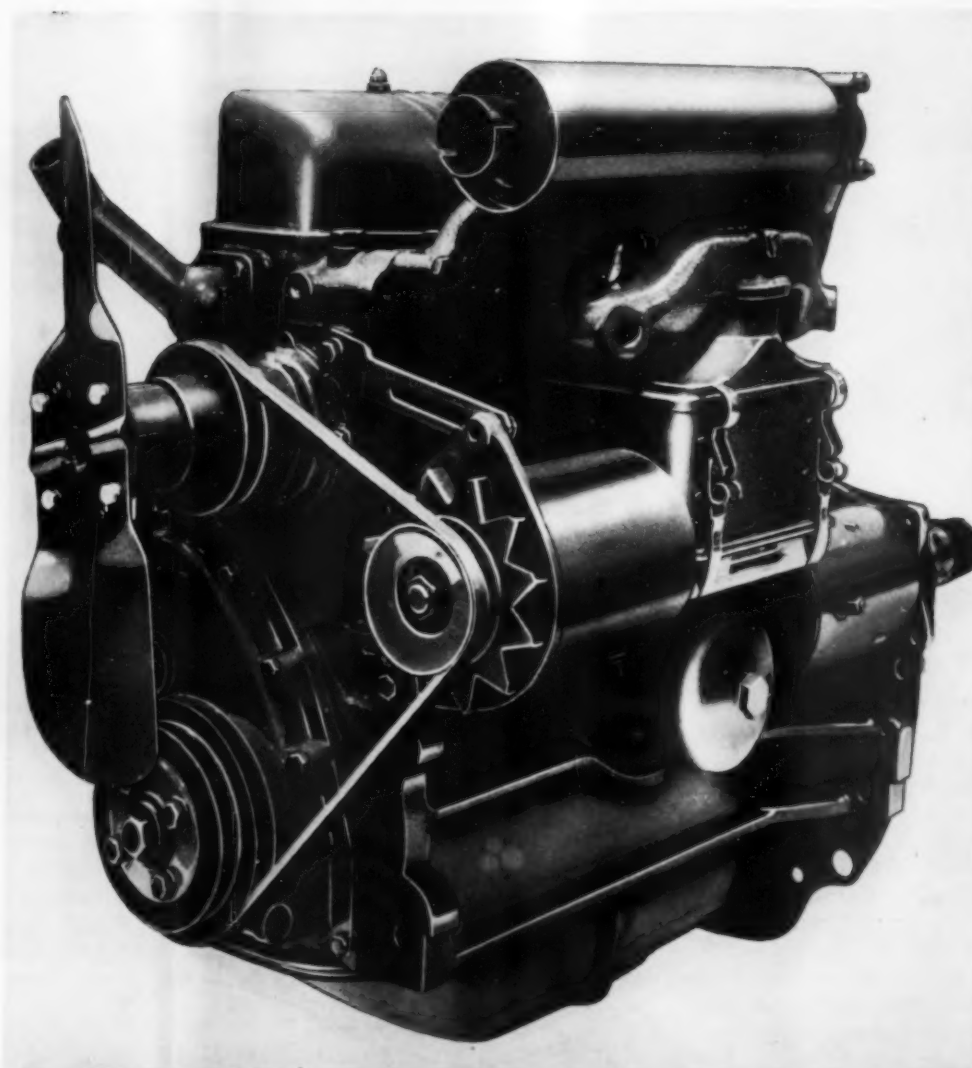
THE third member of Ford Motor Company's line of diesel engines, introduced recently, has gone into production by the firm. Designated the model DD in the 172 cu. in. series, the engine is a four cylinder high compression unit with overhead valves, full pressure lubrication and a rating of 59 bhp at 2400 rpm. It is available either as a basic engine for OEM or repowering use or as a power unit complete with instrument panel, radiator and housing. The engine and power units are designed for use in construction, industrial, agricultural, logging, materials handling mining and oilfield equipment applications. They were designed by Ford's Industrial Engine Department.

The Model DD joins the other two models in the Ford line, the model X 220 Four (60 hp at 2250 rpm) and model Y 330 Six (96 hp at 2250 rpm).

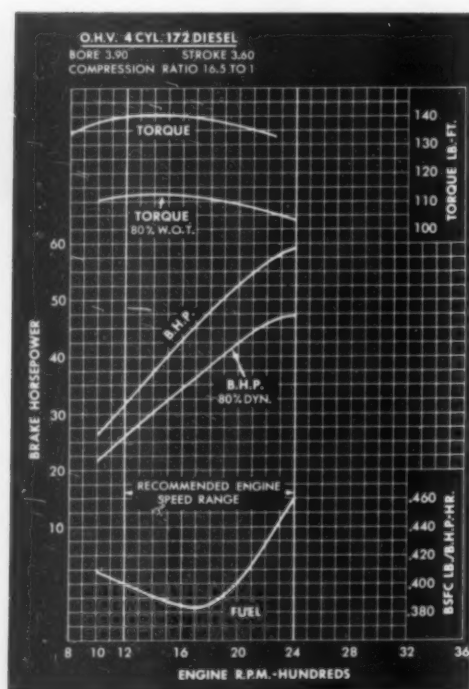
The new Ford unit is an oversquare engine with a bore of 3.9 in. and stroke of 3.6 in. for a compression ratio of 16.5:1. Total piston displacement of 172 cu. in. is the same as Ford's gasoline engine in this series and many of the parts of the two engines are interchangeable. These include valve springs, push rods, tappets, oil pan, water pumps, cylinder sleeves, timing gears, oil pump, camshaft and oil seals. The diesel engine also has the same mountings and fittings as the gasoline engine, making it interchangeable as a complete unit.

Cylinders and crankcase are cast integrally and cylinder liners are the removable dry type. Aluminum pistons have been used for rapid heat conductivity and weight reduction. Each piston is fitted with three compression and two oil rings with the top compression ring chromeplated.

The crankshaft is supported on three bearings with main and connecting rod bearings of copper-



New Ford 172 cu. in. diesel engine has a number of parts that are interchangeable with Ford gasoline engine of same displacement. Engine is rated 59 bhp at 2400 rpm.



lead sleeve design. Intake and exhaust valve guide bushings are replaceable; exhaust valve seat inserts are of chrome-moly alloy steel.

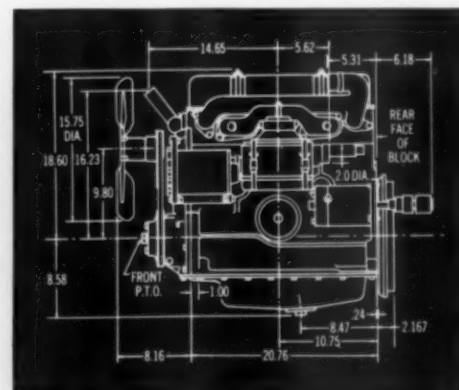
Lubrication is by full pressure feed to rods and bearings and lube oil capacity of the dry engine is five quarts. Fuel injectors are the four hole, long stem type with hole diameter of 27 mm. Injection pressure is 187 atmospheres. The governor-equipped pump provides automatic injection advance to match engine speeds. Cooling water capacity is 15 quarts with the cylinder head and block designed for full-flow cooling.

The engine generator is available as a two pole shunt wound unit in either a dustproof or vent type model. A 12 volt starting motor is standard equipment. Weight of the dry engine is approximately 575 lbs., including a standard flywheel.

Power curve for 172 Four model DD diesel engine.

172 diesel engine measurements show compact size of the unit.

The new engine has a simple, lightweight design that should provide long engine life, simple servicing, and low maintenance and down time. The model provides high torque necessary to hang onto a load without stalling and a number of accessories, including three or four speed transmissions, torque converter with power takeoff, and heavy duty clutch power takeoff, aid in fitting the engine to a number of varying applications.



DIESEL AND GAS ENGINE PROGRESS

an element here
and an element here

assures 99.98%
filtration efficiency
even when 1 element
is out of operation

IT'S THE NEW PUROLATOR TWO-STAGE FILTER

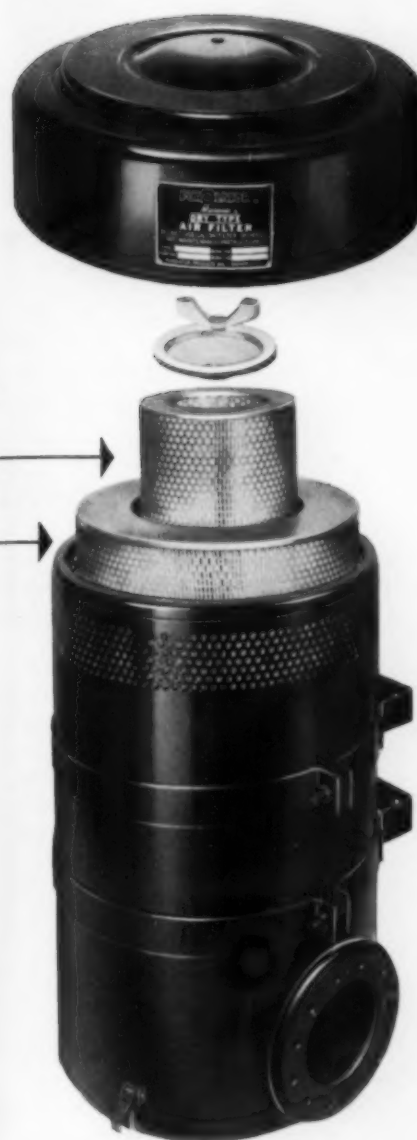
Simplicity of design makes the first cost of Purolator's new dry-type two-stage filter as low as any two-stage filter on the market. Each element filters independently, and together they dustproof your engine as no other filter can . . . 99.98% efficient.

Users save money and get better engine protection from this new Purolator filter, too. The first stage element will last up to 2000 hours, depending on operating conditions. The second stage will usually last almost indefinitely if the first element and sealing gaskets are maintained properly.

Another big user-advantage is the way the two-stage design protects the engine despite accidental mishandling of the element. Even if the first stage element is damaged, the chance of harming the engine can be discounted when it is protected with the second stage back stop element. In addition, the second stage element lets the operator service the unit in the field, regardless of how dusty the conditions are.

Both elements filter uniformly, in depth, over their whole surface, because they're both precision made of plastic impregnated cellulose. This series of two-stage filters is rated from 450 to 1150 cfm, with exceptionally low initial restriction. Mounting straps, rainhoods and outlet adapters are available.

For more information write to Purolator Products, Inc., Department 3896, Rahway, New Jersey.



Purolator Products, Inc.

Dept. 3095, Rahway, New Jersey

Please send me complete data on the new Purolator two-stage filter series.

Name _____ Title _____

Company _____

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City _____ Zone _____ State _____

Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, CANADA



DIESEL SERVICE PROGRESS

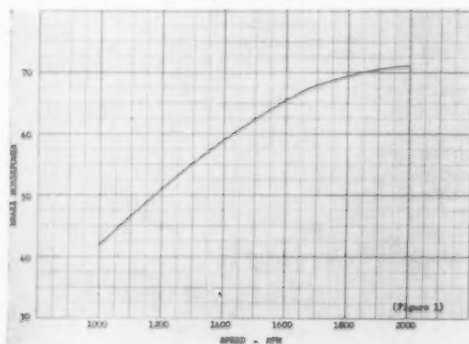
A COMMENTARY BY GEORGE R. MACKEY

George R. Mackey was long associated with Detroit Diesel Engine Division of General Motors Corp., and had prior experience as a mechanic in Europe and the U.S.A., which enabled him to become well acquainted in the diesel and service fields and to obtain a broad scope of the service industry from the customer's and management's viewpoint. Further training at Carnegie Tech and in the Army Ordnance during World War II provided the necessary requirements in planning service programs. Progressive advancement in diesel service areas in General Motors and with Detroit Diesel led to his position as Supervisor of Service Promotion. Upon termination of employment with General Motors in 1952, he joined Clayton Manufacturing Company, and his present position with this organization is Sales Manager of the Dynamometer Division.

Engine and Torque Converter Performance

SINCE development of the earliest internal combustion engine, man has tried to devise methods to smoothly transmit the power developed to perform useful work over a wide range of speed. Due to the performance characteristics and low operating efficiency of these early engines, power transmission methods applied left much to be desired. Even with the introduction of the diesel engine as we know it today, man still searched for a device which would automatically and instantaneously provide an infinite variety of performance ratios exactly proportionate to the work load required. For continuous duty requirements, belt drive was the best available means of transmitting engine power. For operations requiring variable power throughout a wide speed range direct belt drive was not the answer, for, if load demands were too great engine speed was lugged down below desirable operating conditions. When only light load was required a steady hand on the throttle or sensitive governor control was a definite necessity to prevent damage to equipment or dangerous engine overspeed. With the development and perfection of gear boxes and easy-to-operate transmissions many of the desired requirements were met, and, for many types of applications these devices performed admirably. Even with the refinement of gears, however, for infinite variations in power and speed the operator was still required to shift gears and control operating speeds by exact manipulation of the throttle.

Figure 1



With the advent of the torque converter, man's search for smooth, steady power at desirable engine operating speeds, and elimination of gear shifting in many types of operations, was answered. This method of transmitting power eliminated engine lugging and stalling. It permitted engines to operate within the most efficient speed range and produce close to rated horsepower regardless of load demand throughout a wide output shaft speed range. Transmission of power through a fluid in motion, instead of through strictly mechanical devices, contributed greatly to the elimination of load shock, vibration and torsional effects. For many types of operations, clutches and gear shifting were completely eliminated.

Because of the demands on the diesel industry for equipment which would perform more work in a shorter period of time, the use of torque converters has reached into many fields of operation. Today diesel engine converter drive is popular in shovels, tractors, heavy trucks, railroads, construction machinery and many other applications. This great diversification and acceptance has led us into using converters, and other than what is required for normal preventive maintenance, giving very little thought to the benefits and advantages provided in its performance in varying conditions.

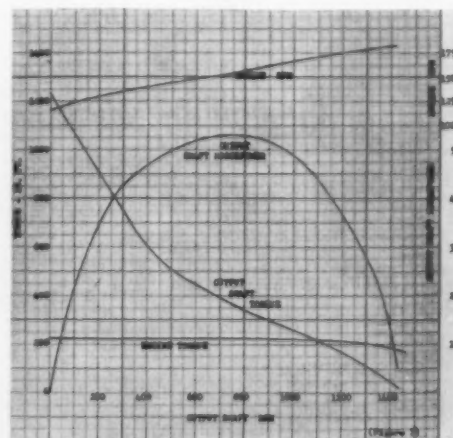
A close study of an engine power curve, (Figure 1) shows as increased load is applied, power and speed fall off; but when this engine's power is transmitted through a particular type of converter, (Figure 2) engine speed remains within a desirable and safe operating range even should the output shaft of the converter be loaded down to stall. Furthermore, as load is applied to the converter shaft engine torque is multiplied many times until at stall more than five times engine torque is developed.

While the torque multiplication features of a converter are readily accepted as a desirable characteristic, the availability of an almost constant horsepower output over a wide speed range is often overlooked. The performance characteristics of this particular converter power unit show a constant

horsepower output, within about 10 per cent over more than 600 rpm operating range. The engine torque within this speed range is multiplied more than four times, as load demands slow the output shaft. Even though horsepower remains constant, torque is increased and shaft speed decreases, the engine speed does not decrease more than 250 rpm. Reference to these curves will show that while the maximum rating of the engine is 69.5 hp at 1800 rpm, and 64 hp at 1550 rpm, through the converter at least 80 per cent of the engine power is available at the output at about 50 per cent of the engine speed. The percentages of engine power and speed at the converter shaft will vary with different makes and models.

The performance characteristics of other type converters show the same basic functions. This can be evaluated by studying the engine power curve, (Figure 3) and the performance characteristics when this engine drives through a converter, (Figure 4). Because of its design characteristics, this converter's highest efficiency is shown during operation in the fluid coupling range. At this point both engine and converter shaft speeds are higher than those studied on the previous curves: Even so, the basic function of the converters are

Figure 2



GENERAL  ELECTRIC

new

Tri-Clad[®] '55' Brushless A-c Generators



MOTOR STARTING CAPACITY OVER .5 HP PER KW

You get high motor-starting capacity — between .5 and 1 hp per kw — and save on installation and maintenance with General Electric's new simplified-design a-c generators. Reliable, hermetically-sealed silicon rectifiers replace all sliding contacts on this new Tri-Clad '55' line. Elimination of complex mechanical conversion equipment has cut scheduled maintenance drastically (*up to 75%*) and reduced unit weight by 50% . . . size to *two-thirds* that of previous models!

TURN PAGE FOR MORE COMPLETE INFORMATION   

You Save on Shipping, Installation and Maintenance with New Tri-Clad '55' Brushless A-c Generators

General Electric's new brushless a-c generators combine the proven durability of Tri-Clad '55' construction with the simplicity of brushless excitation to give you important savings in purchase cost, installation and maintenance.

Superior forcing ability of the new brushless exciter gives Tri-Clad '55' a-c generators motor starting capacity of over .5 hp per kw, 50% higher than previous equipment.

Tri-Clad '55' brushless a-c generators are available in 10-150 kw ratings at 60 cycles, single- or two-bearing

construction, and for 25, 50, 60 or 400 cycle operation. You may choose from a wide selection of engine couplings and adaptors.

For further information, contact your G-E Apparatus Sales Office or write for Bulletin GEA-6844, Section 873-01, Schenectady 5, N. Y.

SMALL AC MOTOR AND GENERATOR DEPARTMENT

GENERAL  ELECTRIC

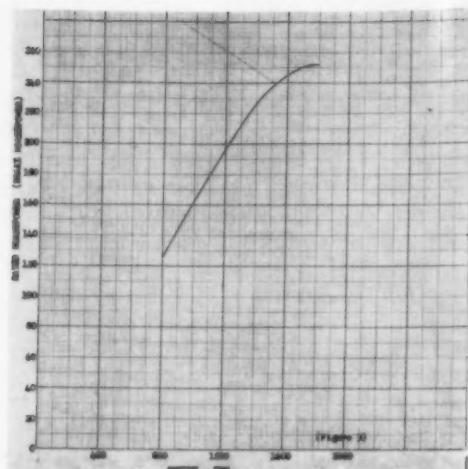


Figure 3

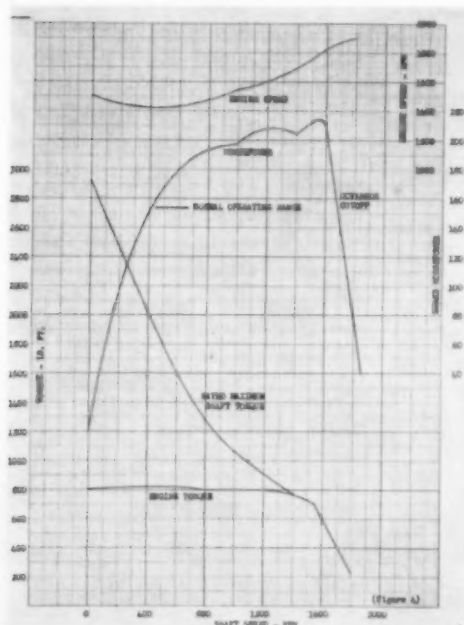
similar. This converter also provides a close-to-constant horsepower output over a wide speed range. By applying the formula $HP = T \times RPM$ to

5250

the torque curve over a given speed range, it will be seen that the horsepower output remains almost constant, within 10 per cent over more than an 800 rpm range of operations. The curves also show that torque is increased as the horsepower remains constant with decreasing shaft speed and the engine speed shows only a 350 rpm decrease.

Today's wide selection of diesel engines and equally wide selection of torque converter models provides an extremely wide range of smooth, efficient power and speed.

Figure 4



READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG**, Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs just \$10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG**, 9110 Sunset Blvd., Los Angeles 46, Calif.

OCTOBER 1960



Two General Motors diesel engines, driving ac and dc generators, provide motive, steering and control power for this giant Tree Crusher used to help clear a pine thicket near the Atlantic City airport.

"TREE CRUSHER" LEVELS THICKET AROUND AIRPORT

CONTRACTORS are mowing down trees like a suburbanite mows his lawn with what is likely the world's biggest "power mower." They're clearing a dense growth of scrub pine and oak from 1200 acres of the sandy New Jersey soil. The "power mower" they're using is a 150 ton monster called a *Tree Crusher* by its manufacturer, R. G. LeTourneau, Inc. of Longview, Tex. It consists of two steel drums, 20 ft. wide by eight ft. in diameter, connected like the wheels of a bicycle. Electric motors and gear units inside the rollers drive them along with power supplied by a 700 hp diesel generating plant carried between the two rollers.

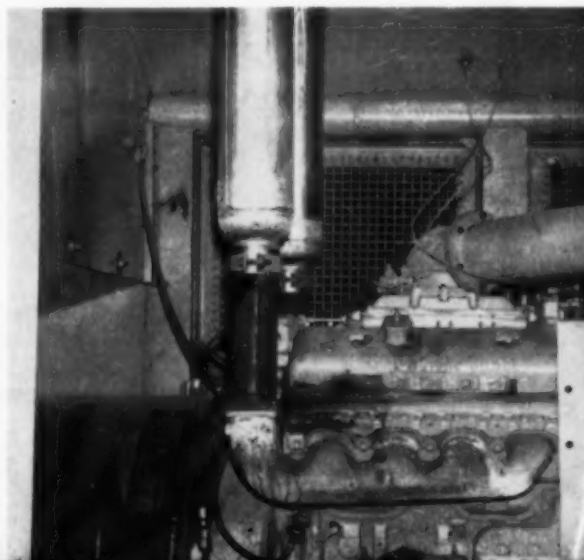
Power for the roller motors is supplied by two GM diesel engines mounted in a bolt-on assembly atop the machine. A GM 12V71 diesel drives a LeTourneau ac generator and a LeTourneau dc generator direct coupled to the flywheel. A GM 8V71 diesel engine, at the other end of the assembly, drives a dc generator through direct flywheel coupling, and a dc excitation generator belt driven from the front of the engine. Both dc generators provide electric power for driving the huge rollers. The ac generator supplies power for steering and controls. Radiators for the power plant face each other at the center of the assembly. Suction type fans are used on each engine.

When this huge apparatus rolls, trees and brush are crushed to the ground along with practically anything else that gets in its path. Hundreds of

axe-head cleats welded to the steel rollers chew up the flattened trees as the machine rolls over them, leaving a "fibre rug" of splintered wood, leaves, and twigs where a few moments before a thicket grew.

Clearing was ordered by the National Aviation Facilities Experimental Center, which encompasses the Atlantic City Airport and is charged with testing and developing new methods and devices for improvement of the federal airways system. Dense vegetation around the airport was interfering with some of their test programs for electronic equipment. By using the giant LeTourneau machine to splinter trees and compact the debris into a mat, the contractors plan to protect the surface from erosion while at the same time leaving it in a condition that will permit control of regrowth. Control of runoff is of major significance—the area is on the watershed of the Atlantic City Reservoir. Usable timber was removed beforehand.

This GM 8V71 diesel engine is directly coupled to a LeTourneau dc generator. Engine also drives dc excitation generator through belt at front of unit. The GM 12V71 engine has ac and dc generators coupled in line.



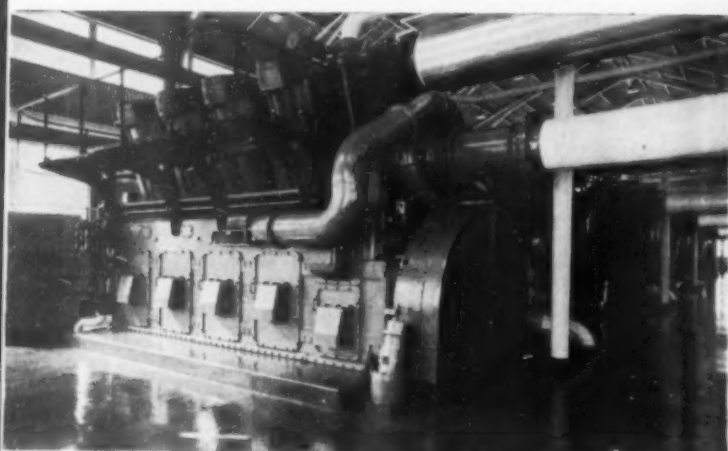
Quick-Release Bolt

A patent has been applied for on a design to combine the threaded advantages of a bolt with the features of a quick disconnect fastener, it is announced by Avdel, Inc. This fastener, for tension applications, will replace conventional bolts that are turned into tapped holes or nut plates, wherever

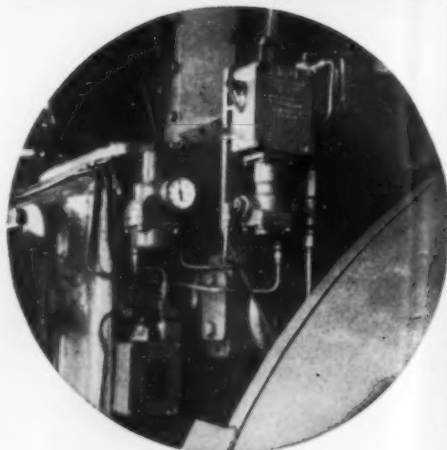
speedy assembly or disassembly is necessary, according to its makers. Bolts are engaged or disengaged by releasing or depressing a button that operates a spring-loaded mandrel. The mandrel maintains a positive locked-in contact between threads of tapped hole, or nut threads, with threads on quick-release bolt. For more information write Avdel, Inc., 210 S. Victory St., Burbank, Calif.

Let AMOT CONTROLS "Stand Watch"

- ✓ With the ever increasing emphasis being placed on improved safety and automatic systems by engine builders and pipe line transmission companies, AMOT CONTROLS are being specified more and more for the protection of vital equipment.
- ✓ All major domestic engine and compressor manufacturers offer AMOT products either as standard or optional components of their control systems.
- ✓ Why not call your AMOT representative for suggestions on your control requirements? Better still, specify AMOT to your equipment supplier.



Shown in these installation photographs are 2000 H.P. Cooper-Bessemer Compressors at a new Tennessee station of the American Louisiana Pipe Line Company.



AMOT CONTROLS CORPORATION

FIRST STREET & NEVIN AVENUE

RICHMOND, CALIFORNIA

West Coast News

By James Joseph

FIVE 16000 Allis-Chalmers diesel generator sets (125 kw at 1800 rpm) with brushless generators (Norwalk Div. of Allis-Chalmers) have been sold to the Corps of Engineers by Andrews Equipment Service of Washington, Inc., Spokane.

DELIVERED: three Caterpillar D330 turbocharged diesel electric sets (60 kw at 1800 rpm) to Guy F. Atkinson Co. for auxiliary power on contractor's Oroville-Wyandotte project in northern California. Sale by San Leandro, Calif.'s Peterson Tractor Co.

TO California's Division of Forestry, a GM 3-71 engine (109 hp at 2300 rpm) repowering a model 88 Austin Western grader. Sale by Rhea Tractor & Engine Co., Sacramento.

FOR auxiliary power aboard one of HandM Sportsfishers boats, a Lister-Blackstone SL-3 (12¾ hp at 1800 rpm) driving a 7½ kw Winpower generator.

FOR the Cinder Mining operation near Baker, Oregon, a 100 kw, 1200 rpm Allis-Chalmers generator set, purchased by La Grande, Oregon's Lewis Statler. Sale by Hamilton Engine Sales, Inc., Portland.

TO Fred Tadlock, Zamorro, Calif., a Lister-Blackstone HB-2 (24 hp at 2000 rpm), the air-cooled engine to power a Heston 12 ft. hay mower. Sale by Oswald Machine Works, San Francisco.

DELIVERED: to the Lawrence Radiation Laboratory, University of California, for standby power, a Caterpillar D342 turbocharged diesel electric set, 150 kw at 1200 rpm.

SOLD: by San Pedro, Calif.'s Bolstad Sales & Service, a Lister-Blackstone SL-2 5 kw AC generator set as auxiliary power aboard Mission Bay Sportsfishing craft "Mission Queen," operating off San Diego.

REPOWERED: an Austin Western grader model 99, operated by San Bernardino (County) Road Dept., Calif., with a GM 4-71 diesel. Sale by Anderson-O'Brien Co., Los Angeles.

TO the Corps of Engineers, an Allis-Chalmers 200 kw generator powered by a 21000 Allis-Chalmers diesel. Sale reported by Hamilton Engine Sales, Inc., Portland.

DELIVERED: to SP & S Railway, Portland, Oregon, a 125 cu. ft. diesel combination rubber tire and standard gauge

(4 ft. 8¼ in.) railroad wheeled vehicle (operates both on tracks and on rough terrain), for maintenance-of-way section. Unit operates 18 ft. sickle (for mowing), air compressor for painting, air hammer and rotary cleaning brush.

FOR the fishing boat *Seaworthy*, operating off San Francisco, a Caterpillar D342 turbocharged marine diesel with 3:1 Cat marine reduction gear, producing 220 continuous hp at 1200 rpm. Sale by Peterson Marine, San Leandro, Calif.

TO Malibu Pier Corp., Malibu, Calif., a Lister-Blackstone SL-2 (8½ hp at 1800) to power bait pumps aboard sportsfishing boat. Sale by San Pedro's Bolstad Sales & Service.

FOR Shields Construction Co., Eugene, Oregon, a 15 kw generator, Allis-Chalmers diesel, for operating portable lighting equipment.

OPERATING in western states: first of new Getman model KD-5A Scoot Crete Ore Carriers, 250-300 cu. ft. capacity, powered by Deutz A6L 614 engine (110 bhp at 2000 rpm).

FOR repowering school bus serving Ontario (Calif.) School District, a C160 (160 hp at 2500 rpm) Cummins diesel installed in Gillig bus. Sale by Rialto, Calif.'s Smith Diesel Sales.

V. R. DENNIS Construction Co., San Diego, has taken delivery of two NHRS-6-BI supercharged Cummins diesels to repower DW-20 Caterpillar earth movers. Sale by E. W. Equipment Co., San Diego.

FOR Moss and Meadows of Boise, Idaho, who in turn will lease rigs to Armour Truck Lines (which handles haulage of Armour products), a fleet of 10 dieselized Kenworth trucks. Moss and Meadows are based in Boise, Idaho.

TO Stockholm, Sweden's Aktiebolaget Sindia company, 400 American MARC Model 10 diesel outboard motors, 10 hp at 3500 rpm, to power fishing boats.

Insulation Brochure

Increased reliability, greater versatility and longer life are the outstanding characteristics of wire and cable insulated with Silastic brand silicone rubber according to a new descriptive manual published by Dow Corning Corp. With data charts and graphs, the brochure explains why Silastic insulated wire and cable has greater load carrying capacity. A variety of existing applications for Silastic protected wire and cable are pictured in this new booklet available from Dow Corning Corp., Midland, Mich.

ITS NEW

Michigan-Ohio News

By Jim Brown

FRED Barton of Bar Product and Supply Co., Holly, Mich. recently accepted delivery on an International TD-15 with Drott 4-in-1 loader. The new loader will be used for land improvement work in the Holly area, and was purchased from Wolverine Tractor and Equipment Company of Detroit and Grand Rapids.

PENINSULAR Diesel Inc. of Detroit has installed a GM model 5047-7241 in a Ford C-750 truck. The installation was done for Truck Equipment Co. of Grand Rapids, Mich.

EARLE Equipment Co. of Detroit recently sold an Allis-Chalmers HD6E diesel tractor with a hydraulic dozer attachment to Motor City Excavating (Detroit) for general excavating work.

CUMMINS Diesel Michigan Inc. of Dearborn, Mich. recently installed an H-6-BI Cummins diesel in a Euclid 36FD truck (off-highway). The engine is rated at 160 hp at 1800 rpm and was installed for the France Stone Co. of Toledo, Ohio.

A Continental model GD-194 (4 cylinder) open-type power unit was recently delivered to Telischek Co. of Livonia, Mich. Sale was made by Continental-Kromis Engine Sales & Service of Detroit.

TERRA Construction Co. of Detroit has accepted delivery on an Oliver OC-4-3D bulldozer powered by an Oliver 3-cylinder diesel engine. Sale was made by Cyril J. Burke, Inc. of Detroit.

WOLVERINE Tractor & Equipment Co. has sold a Hough H-90 Payloader powered with a Cummins C-175 turbocharged engine to Paul Miller of Sparta, Mich.

A General 320 crane (3/4-yd.) was recently converted from gasoline to diesel with the installation of a GM 3055C engine. The installation was done by Peninsular Diesel Inc. of Detroit for Bowen & Fullerton of Muskegon, Michigan.

RALPH Gay of Midland, Mich. has accepted delivery on a 1 1/2-yd. Allis-Chalmers TL-14DA Tractor-loader equipped with an Allison transmission. The sale was made by Earle Equipment Co. of Detroit.

MACKINAW Co. of Essexville, Mich. has accepted delivery on a Cummins NH-220B replacement engine for installation in their B-70 Mack truck. The engine was supplied by Cummins Diesel Michigan Inc.

CHARLES J. Rogers Construction Co. of Detroit has purchased a Northwest Model 6 erection crane with a 40 ton capacity. The new crane is powered by a Murphy diesel engine and was sold by Cyril J. Burke Co. of Detroit.

APPOINTMENT of Martin Bever to the truck engine sales and engineering division of Michigan Tractor & Machinery Co. of Detroit has been announced by Kenneth R. Dickinson, vice president-sales manager, of the Caterpillar distributor.

CLARENCE Yenglin of Pidgeon, Mich. has accepted delivery on a Hough H-90 Payloader powered by a Cummins C-175 turbocharged diesel engine. Sale was made by Wolverine Tractor & Equipment Co.

A 107 hp General Motors diesel engine, a range of bucket sizes and three new attachments are now available as optional equipment for Michigan model 85A tractor shovels, according to the Construction Machinery Division, Clark Equipment Co. of Benton Harbor, Mich.

DIGGERMAN Inc. of Wyandotte, Mich. has accepted delivery on an Allis-Chalmers HD6G 1 1/2-yd. diesel tractor shovel with a TR-6 ripper assembly. The sale was made by Earle Equipment Co. of Detroit.

CUMMINS Diesel Michigan Inc. has recently installed a Cummins JT-6-B in an IH 220 truck. The installation was done for H. James Fry Trucking Co. of Old Fort, Ohio.

NELSON Sharrow of Marine City, Mich. has accepted delivery on a Yaeger model 250 compressor. The compressor is powered by a GM 3-71 engine, runs at 1700 rpm, and was purchased from Cyril J. Burke Inc.

EARLE Equipment Co. has delivered an Allis-Chalmers HD11E diesel tractor with hydraulic bulldozer blade to Dykhouse Brothers of Grand Haven, Mich.

BAW Trucking of Wyandotte, Michigan has had a Cummins NH-250-B diesel engine installed in an LJT-1-D Mack tractor. The installation was done by Cummins Diesel Michigan Inc.

A Northwest Model 25D pullshovel powered by a Murphy diesel engine was delivered by the Charles J. Rogers Construction Co. of Detroit by Cyril J. Burke Inc.

JACK Weber Sand & Gravel Co. of Pontiac, Mich. has accepted delivery on an Allis-Chalmers model HD16DC (long track) tractor. Sale was made by Earle Equipment Co.

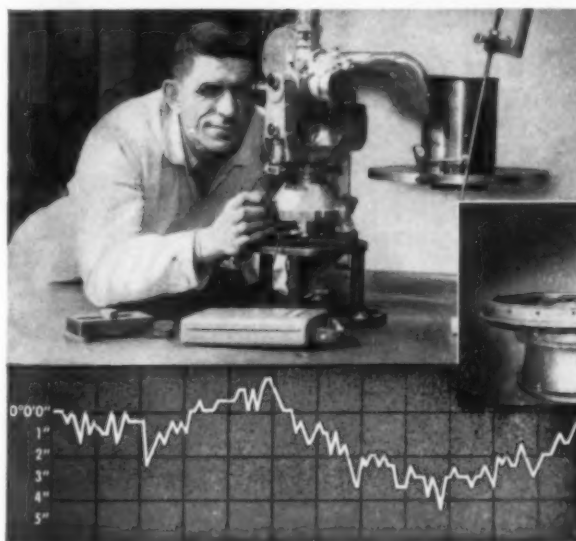
Young Sales Representative

Appointment of Lloyd A. Alaback as a new sales representative for the Young Radiator Co. has been announced by the Company's Industrial and Oil Field Division. Mr. Alaback heads the Thermal Engineering Company, Tulsa, Okla. He will promote the sale of Young products in the Tulsa area.

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG**, Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10 1/2 x 13 1/2", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just \$10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG**, 9110 Sunset Blvd., Los Angeles 46, Calif.

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▲ Actual graph of index wheel accuracy readings in seconds of arc at each 3° (rotation) interval

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Anti-Rust Concentrate

An eight-page, two-color brochure describing SARC (Special Anti-Rust Concentrate) has been published by the developers and marketers of the product. SARC is said to inhibit rust and corrosion in heavy-duty equipment cooling systems through the formation of a thin, protective film on metallic surfaces. This microscopic film arrests the damage caused by rust and corrosion already formed and at the same time inhibits the formation of new rust and corrosion. The booklet points out that the newer, bigger and more powerful engines of today place a tremendous demand on cooling systems, thus creating a vital need for the best possible protective agents. The product contains two iron oxide-combating ingredients which working together, the brochure explains, are believed to be unsurpassed in effectiveness in controlling rust and corrosion. Special features of the brochure are sections on the historical as-

pects of rust and an overall four-point program for better cooling system maintenance. For a copy write Lubrication Engineers, 2809 Race St., Fort Worth, Tex.

ITS NEW

Add 37 I-H Tractors

Wayne Dohrn, president of Dohrn Transfer Co., has announced the purchase of 37 diesel-powered International highway tractors as part of a fleet expansion and modernization program. Cost of the purchase was close to \$500,000, according to Dohrn. The new Internationals are compact-design BC-225-D models with Cummins 180 horsepower diesel engines, 10-speed Road-ranger transmissions and 143-inch wheelbases. They will be used throughout the Dohrn territory of Illinois, Michigan, Indiana, Iowa, Missouri, Ohio and Kentucky. Addition of the new Internationals brings the number of trucks in the Dohrn fleet to 380.

Delaware Ferry

The Delaware State Highway Department announces the awarding of the building of a 65 ft. steel ferry boat to RTC Shipbuilding Corporation, Camden, N.J. The Annapolis, Md. firm of George E. Meese, naval architects and marine engineers, designed the passenger vessel which will be put into service at Woodland, Del., on the Nanticoke River, for daylight service only. The vessel, to be classed *A1 Ferry Service by the American Bureau of Shipping, will carry three cars or two light trucks. The double ended hull with twin propeller tunnels will be guided across the river on a cable. Propulsion will be a JN6M Cummins Diesel engine fitted with two Twin Disc clutches, each driving a Walters reduction gear and a propeller.

Survey Waterway Potential

The country's first across-the-board appraisal of its inland waterway potential reveals opportunities for major expansion of barge navigation to help carry the doubled freight load expected by 1980. Results of the study, made by the Army Corps of Engineers at the request of the Senate Select Water Resources Committee, are presented in a report by Senator Robert S. Kerr, of Oklahoma, Committee Chairman. The report stated that all transportation systems will relatively soon be taxed to the limit to meet an expected 100 per cent increase in total freight load 20 years from now and quadrupling of the load by year 2000. To help meet these demands, the Corps of Engineers believes about half the commercial waterways can be expanded by enlarging channels, navigation locks and other facilities to accommodate trends towards larger barge tows and more efficient navigation operations. Also, the construction of some 3,000 mi. of new waterways, reaching into areas not now served, appears to have engineering feasibility. The cost of expanding the old waterways and building new ones would total some \$7.9 billion. Questions of how much waterway capacity should be increased, which projects should be built, and when the developments should be carried out, will have to be determined for specific projects as additional transportation facilities are needed, the report advised. In its study, the Corps of Engineers found that 18,960 mi., or 85 per cent of the 22,231 mi. of inland waterways, exclusive of the Great Lakes, it had improved and operated since 1824 at a cost of \$2.8 billion, are in constant operation, carrying commercial freight. The Nation's commercial inland waterway systems, including 525 miles improved by other than Federal Government effort, and 668 miles that required no work, now

total 20,153 mi., without counting the Great Lakes. About 94 per cent of this mileage was improved by and is operated and maintained by the Federal government. About one-third of this system has channels of less than 9 ft. in depth, considered antiquated by today's commercial standards, though much of it is valuable for recreation. About 32 per cent of the active commercial system has channel depths from 9 to 12 ft., 20 per cent from 12 to 14 ft. and 13 per cent over 14 ft. The report suggests that further studies be made of 88 waterways, no longer carrying freight and not included in the active commercial system, to determine the extent of Federal responsibility for them.

Test Turbine Booster

Experimental run of an AiResearch natural gas burning turbine as part of a system to boost gas well head pressure to pipe line pressure has begun in Corpus Christi, Texas. A product of The Garrett Corporation's AiResearch Manufacturing Division, the 100 hp model 70 turbine is serving round-the-clock as a first stage compressor to replenish pressure lost by depletion in a gas gathering system. Purpose of the experiment is to provide experience and performance data on natural gas burning turbines for new industrial applications. The turbine is slightly modified from similar liquid fueled, shaft power units produced by AiResearch and in use by the U.S. Air Force, Navy and Army. For the Air Force the small jet engines provide auxiliary power on board the KC-135 jet tanker; and by the Navy on board P5M seaplanes; they also supply prime electrical power for the Army as ground support for the Sergeant missile. In the simple modification the turbine fuel cluster is replaced by a standard AiResearch speed sensor and valve which regulate the gas flow. Only other modification is the replacement of the fuel atomizer with a nozzle.

Pad Mounted Transformers

A new economical transformer designed especially for commercial suburban areas with heavy low voltage load concentration has been introduced by Allis-Chalmers. The new commercial pad mounted transformer is suitable for use in shopping centers, hotels, drive-in theaters, schools, motels, etc. Unnecessary gauges and accessories have been eliminated. This results in a modern uncluttered exterior with locked and tamper-proof high and low voltage enclosures. No vault or fence is required. Commercial pad mounted transformers are available in three phase sizes, 225 through 1500 kva with high voltage 2400 through 13,800 (no taps) and with a low voltage of 208Y/120 or 480Y/277.

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Simple—Only 8" long, 3 1/4" wide, 5 1/2" high . . . weighs less than 10 pounds . . . fewer parts to service, fewer adjustments to make.

Versatile—Because of accessories that can be built in or added at low cost taking up no, or very little, valuable engine block space.

Economical—Initial cost is less, costs less to service, saves money because of its dependable service.

Write for guides to better fuel injection. One features the pump, the other an efficient, economical filter.



HARTFORD MACHINE SCREW CO., HARTFORD 2, CONN.
Division of Standard Screw Company

Florida Diesel News

By Ed Dennis

THE *Chanticleer*, owned by Ralph Evinrude, the outboard motor king and husband of singer Frances Langford, is being repowered at Gibbs Corp. in Jacksonville with two General Motors 6-71E tandem (four) diesel engine sets plus two 30 kw 3-71E GM diesel-generating sets. Engineered by the Miami Br. of Detroit Diesel Div., GMC.

UP at Deerfield Beach, the Mobile Asphalt Co. is assembling a new concept in a mobile asphalt plant to be powered by a D326F Caterpillar dieselized 100 kw generating plant plus two more D326F Cats and one D337 Cat power unit with Twin Disc power take off, to run the component parts of this *Circus Plant*. The whole plant consists of 19 pieces of machinery.

AT Sumterville, the Quality Lime Products Inc. has three Allis-Chalmers HD16 crawler tractors equipped with dozers for clean up work and stripping overburden around the quarry. These tractors are powered with Allis-Chalmers 16000 diesel engines and are rated 170 hp. Also at the pit are six new Allis-Chalmers TR-260 20 ton rock wagons. All the units came from Richardson Tractor Co., Tampa.

BERT E. Roper of Roper Growers Cooperative, near Winter Garden, has purchased one of the first model B-160 International trucks for grove use. It is powered by a model D-301 International diesel engine. This new six cyl. four cycle diesel is rated 110 hp at 3000 rpm. The unit is also equipped with Perry water filter.

THE Gibbs Corp. at Jacksonville, has been awarded a contract to build six 65 x 19 foot Coast Guard tugs. They will be powered with 400 hp Caterpillar diesel engines plus two Cat generating sets.

WARD & Samons Construction Co., Fort Myers, will take delivery of a model No. 111-M Marion four yd. dragline powered with a N V H Cummins diesel rated 450 hp at 2100 rpm and torque converter.

THE Miami Br. of Detroit Diesel Div. GMC supplied a 4-71 diesel to power an irrigation pump for Triangle Sod Co. of Fort Lauderdale and a 4-53 model to Devain of Sebring for a Friend citrus sprayer.

MOVING dirt in the construction of Florida Interstate highway No. 4, were a fleet of five Caterpillar DW21 two wheel tractors and 25 yd. scrapers.

These are powered with Cat turbocharged 300 hp diesels; for push loading, C. Wilson Construction Co. used several Cat D8 and D9's.

A Jet Age job for Cat diesels: Troup Bros. has five DW21 two wheel tractors and 25 yd. scrapers powered with Caterpillar 300 hp turbocharged diesels, moving dirt to extend runways to 10,500 ft. to accommodate the jet planes at Miami International Airport. They operate in convoy preceded by a radio-equipped truck due to air traffic. Two D8 dozers are used to push load. The units came from Shelley Tractor Co.

THE Pompano Beach water treatment plant will receive a model 38F5¼ six cyl. Fairbanks-Morse diesel engine rated 440 hp to power a Fairbanks-Morse water pump.

ANOTHER four cylinder model HRC Cummins to supply power for a B-C irrigation pump. These 5¼ x 6 in. diesels are rated 115 hp at 1800 rpm, from Hialeah Br. Cummins Diesel Sales Corp.

UP near Orlando, the L. A. Reynolds Co., rock contractors, were using Cummins dieselized Michigan dozers. The model 280 is powered with a NTO-6-BI Cummins turbocharged diesel rated 262 hp at 2100. The No. 380 tractor dozer has a NFT-6-BI rated 375 hp at 2300 rpm. Both have Clark 3.0:1 torque converters. This firm also uses a 210 tractor scraper with a 262 hp Cummins diesel.

A model UD 282 International diesel engine was in the Galion 10-14 ton roller that Florida-Georgia Tractor Co. sold to Campbell Paving Co. of Clearwater. The six cyl. 282 cu. in. International diesel is rated 95 hp at 1800 rpm.

THE Miami Br. Detroit Diesel Div. engineered installation of two model 4-53 GM diesel engines, each rated 85 cont. hp at 2200 and Borg-Warner 2:1 r & r gears, for the 42 ft. yacht, *Thunderbird*. Also a single 53 for the bait boat *Miss Manning*.

SHIPPED to the Valle de La Pasca electric plant, Caracas, Venezuela, a model 80-SX-8 Superior diesel to drive a 1250 kw generator. This eight cyl. turbocharged engine is rated 1765 hp at 360 rpm and will be installed with three 12 x 15 model 60 Superiors.

SIMPLEX Sales of Miami supplied the two model 197 DLCSM Waukesha marine diesel engines, each rated 105 hp at 2000 rpm, for the 40 ft. sport fisherman, *Vera III*, operating out of Hillsboro Inlet. Installation also included 2:1 Capital r&r gears to drive the 22x24 three blade propellers.

THE *Titian*, a 77 ft. houseboat, had a model 636 Mercedes-Benz diesel installed to power a 10 kw Onan generator. This 36 hp unit supplies electrical power for the ship's air conditioning system.

H. G. Simpson took delivery of his 40 ft. *Me Too* from Miller Yacht Sales in Fort Lauderdale. This sport fisherman is powered by a pair of General Motors 4-53 diesel engines and 2:1 G M hydraulic r&r gears.

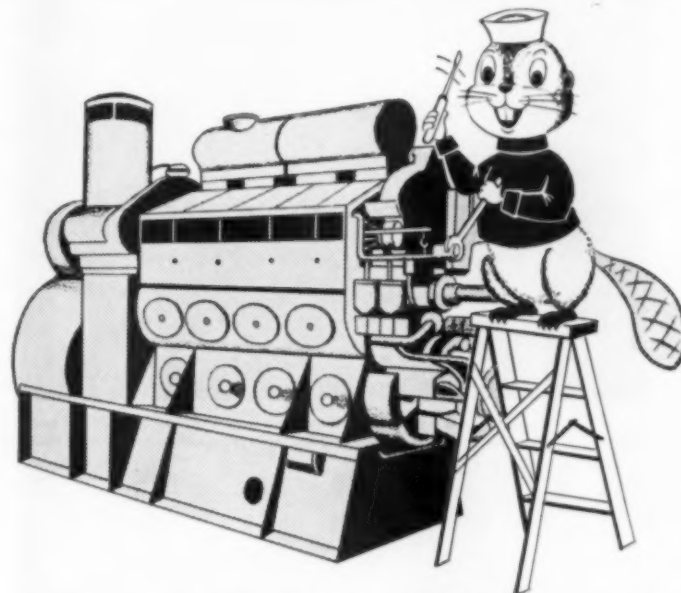
DOWN at Homestead, the Everet Danberly Farms, Inc. received a model D 320 turbocharged Caterpillar powered irrigation pumping unit. Specs included, direct drive to Rainmaster SS6H-100N pump, 1½ in. nozzle Rippey gun, 980 gpm. The unit was engineered by Shelley Tractor Co.

FLORIDA-Georgia Tractor Co. supplied an International TD20 crawler

tractor powered by a 134 net engine hp International diesel to J. W. Conners & Sons contractors of Tampa and a TD 15 crawler tractor with the new 105 hp D 554 International diesel to Bransfield & White of Ojus.

FLORIDA Marine Service, Miami distributors of Chrysler marine engines, will handle the Perkins line of liquid cooled diesel engines. Their territory is the southern part of Florida.

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG**, Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just \$10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG**, 9110 Sunset Blvd., Los Angeles 46, Calif.



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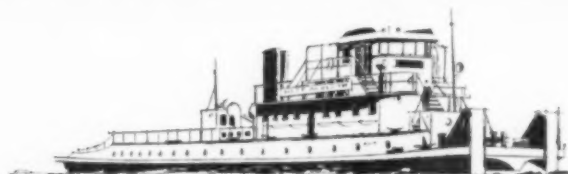
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MEMBER OF THE AMERICAN WATERWAYS OPERATORS, INC.



Westinghouse pneumatic controls have contributed much to the safety, efficiency and economy of diesel-powered craft. In the pilothouse and engine room, these small, panel-mounted devices with their finger tip control assure split-second response to any desired maneuver or speed.



Westinghouse AIR CIRCUITRY gives you finger tip —and it is easy and economical to install and maintain

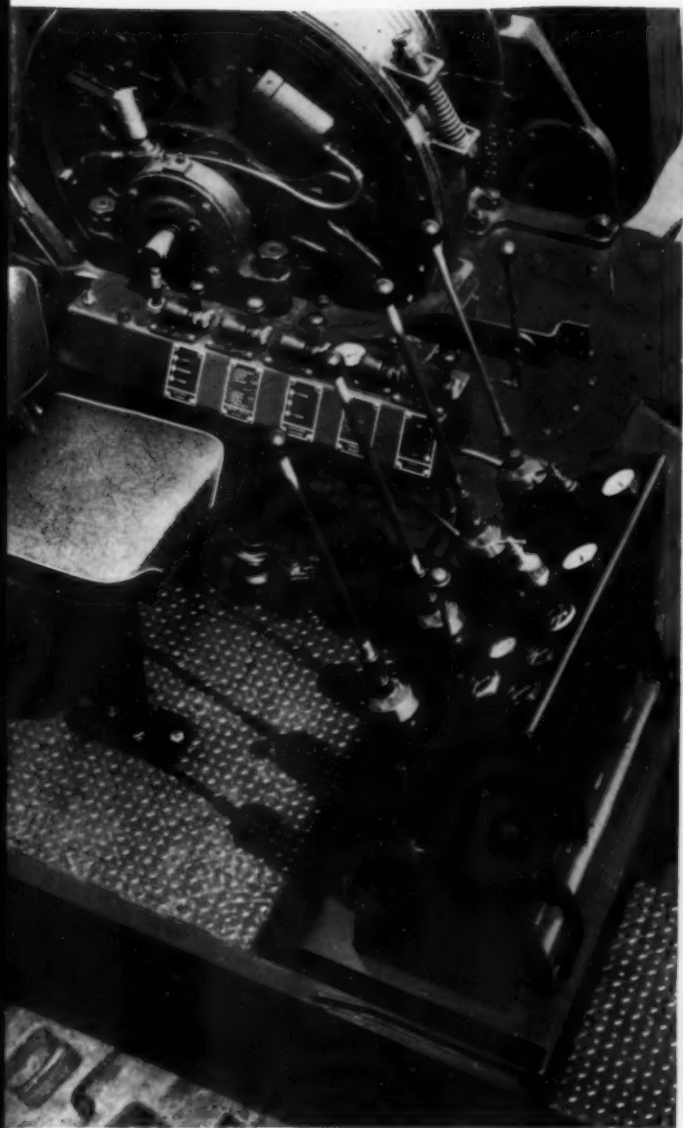
AIR CIRCUITRY is the application of Westinghouse pneumatic control systems to the operation of diesel and other types of engine-powered machinery, equipment and craft. Among its many benefits are:

EASE OF OPERATION—With Westinghouse pneumatic controls, compressed air is the "muscle" that starts, stops or controls the engine, shifts gears, engages clutches, etc. Only a finger tip touch of the control lever is required. And, because Air Circuitry replaces awkward hand levers, there is no

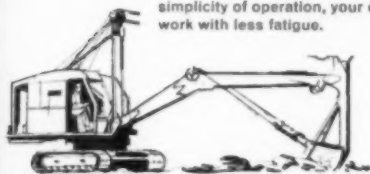
operator fatigue.

SAFETY INTERLOCKS—Even inexperienced personnel can safely operate your equipment because interlocks in the Air Circuitry controls rule out the dangers of improper operation or power failure.

WIDE CONTROL LATITUDE—Your equipment can be operated from any number of remote control stations. Engines and clutches can be operated individually or in unison by a single control lever.



Big shovels and cranes and other diesel-powered heavy construction machines can be manipulated with the greatest of ease when equipped with Westinghouse pneumatic controls. And thanks to the ease and simplicity of operation, your operators can handle considerably more work with less fatigue.



Westinghouse Air Circuity systems are widely used in the oil fields. Their easy finger tip control helps speed the drilling operation. They give you safe, sure, fast-responding control. You can operate them for long periods with little maintenance.



control of your diesel-powered equipment

SIMPLE INSTALLATION—Westinghouse pneumatic controls can be installed quickly by any competent mechanic. No adjustment or fitting of mechanical linkage is required.

INEXPENSIVE MAINTENANCE—Westinghouse pneumatic controls have few wearing parts and fewer adjustments. Equip-

ment is uncomplicated and long in service. Parts and service are readily available in all large cities.

If you are considering new equipment or modernizing your old equipment, our engineers will be glad to consult with you. Write today for free booklets.

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WESTINGHOUSE AIR BRAKE COMPANY

INDUSTRIAL PRODUCTS DIVISION, WILMERDING, PENNSYLVANIA

Cummins Promotes Two



C. R. Boll



R. W. Franck

E. Don Tull, president of Cummins Engine Company, Inc. announced promotion of C. R. Boll and R. W. Franck to top sales positions. Mr. Boll

was appointed to the new position of executive vice president—marketing; Mr. Franck was named vice president—sales. Mr. Boll joined the company immediately after graduation from Purdue University 14 years ago. He served as sales engineer, Assistant regional manager, manager—Engine sales, general sales manager and, most recently, as vice president—sales. Mr. Franck joined the company in 1948 as a market research analyst and has also served as manager—warranty administration and manager—sales development. In 1959 he was advanced to his most recent position as director—field sales. Mr. Franck is a graduate of Drake University and Harvard Graduate School of Business Administration.

Indicating Temperature Cutout



A new, electric instrument which combines automatic protection against excess temperature with continuous temperature indication is now being offered. The unit, called the Alnor Pyrotac, is available in two models. Model N-30 will not shut off upon line voltage failure; model N-34 will shut off in such a condition. In addition to its cutout function the Pyrotac can be used to sound an alarm and/or light a signal upon excess temperature condition, thus allowing a minimum of attendant supervision with complete safety. The instrument also can be supplied as a low temperature cutout when so specified. While primarily intended for use in conjunction with other controllers, the Pyrotac can also serve as the only control instrument on a process requiring complete shut-down upon reaching a final preset temperature, or when operator attention is required upon completion of a temperature cycle. Its design requires only 6 3/8 in. x 7 in. of panel space for flush mounting. The excess temperature controller is available in eleven ranges for 0-400 degrees F. to 0-3000 degrees F., as well as an environmental test chamber range of -100 to -300 degrees F. For more information, write to Alnor Instrument Co., Division of Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.

ITS NEW

Caterpillar Ad Manager



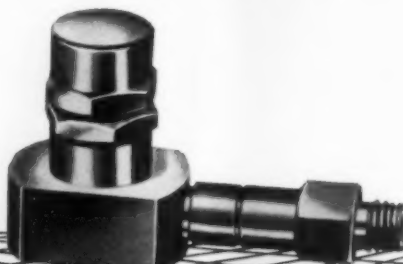
C. B. Leber

Appointment of Charles B. Leber to advertising manager of Caterpillar Tractor Co. has been announced. He succeeds Burt M. Powell who retired on Sept. 1. Mr. Powell had been advertising manager since 1953. Mr. Leber joined Caterpillar in 1947. He has held supervisory positions in sales work and was appointed manager of the sales division of defense products last year. Mr. Powell had been employed at Caterpillar since 1935. After two years as a Caterpillar news writer, he became the first editor of *News and Views*, the company's employee magazine. In 1945, he was appointed manager of sales publications. He became assistant advertising manager in 1948 and advertising manager in 1953.

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AP935

F-M Operations Officer



A. Leo West

A. Leo West, former executive vice president and general manager of Clearing Division of U.S. Industries in Chicago, has been appointed vice president-operations, of Fairbanks, Morse & Co. At Clearing, West was successively controller, director of the budget, and superintendent of production and planning. When Clearing was bought by U.S. Industries in 1954, Mr. West was appointed executive vice president and general manager. He has had extensive experience in both manufacturing and sales. Mr. West also has been controller of International Machine Tool, Indianapolis, Indiana, and of Foster Machine Tool, Elkhart, Indiana.

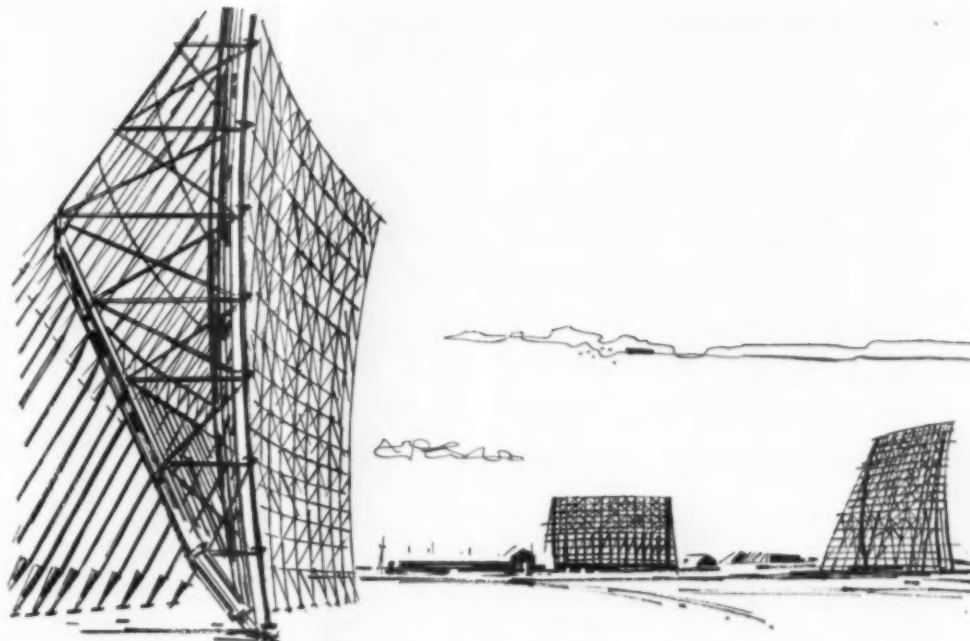
Trans-Canada Turbo-Starters



Above photo shows the assembly line at the Boeing Industrial Products Division for the Boeing Turbo-Starter mobile ground support unit. At head of assembly line are two of Trans-Canada Air Lines' order of 17 Turbo-Starters, three fly-away units and one spare engine which will be used to provide fast starts for TCA's new jetliner equipment. Trans-Canada's Turbo-Starter units are in service from Halifax and Montreal to Saskatoon and Vancouver. Mechanics in the foreground are shown readying a Boeing 502-11B gas turbine compressor for installation in a panel truck. The 205 air hp compressor supplies high flow, low pressure air for the job of starting large jet engines and other ground support tasks.

Fuel Injection Men Attend West Coast Service School

Twenty representatives of registered Roosa Master service stations in California and Utah recently participated in a week long school at Diesel Control Corp., in Wilmington, Calif. Conducting the advanced course on the model D pump and its latest accessories was Bernie Prue from Roosa Master's Hartford, Conn. plant. Mr. Prue is shown in the photograph during a lecture session.



helping keep "THE RADAR BEAM ON" at Greenland...

ELLIOTT TURBOCHARGERS

Elliott turbochargers contribute to the fast-starting capabilities of the Fairbanks, Morse diesel engine generator units installed as a part of the unattended standby power plant of the Ballistic Missile Early Warning System, Thule, Greenland. In less than 30 seconds after failure of the prime power source, these units go into action, producing 12,000 kw of power.

THE RESULT: complete assurance that each of the 4 giant-sized radar screens will be "ON BEAM"—without interruption. Elliott has been a leader in building turbochargers for over 20 years—more than 25,000 units covering the whole field of turbocharged engines—which boost engine performance, output and operation.

ELLIOTT Company
SUPERCHARGER DEPARTMENT
JEANNETTE, PA.

MO-3



One of six turbocharged Fairbanks, Morse & Co. 38D8-1/2 diesel engines driving 2000-kw generators at the Thule, Greenland, standby power plant. Each of these engines is equipped with twin Elliott turbochargers.

WHEREVER engines are used... **VAPOR PHASE®** systems can cut operational costs

VAPOR PHASE COOLING CAN GIVE BETTER ENGINE PERFORMANCE

Vapor Phase cooling systems take advantage of the natural law of boiling liquids to maintain a constant temperature through the water jacket of an engine. Whereas with conventional cooling systems the cylinder wall temperature may vary as much as 40 degrees between the top and bottom—there is a difference of less than 5 degrees with Vapor Phase. By maintaining this constant high temperature, well above the dew point of exhaust gases (194°F.), condensation and the resultant acid formed are eliminated. This means less engine wear—faster warm-ups—better performance—less maintenance. Engines that normally would have required a major overhaul at 8000 hours have operated for more than 25,000 hours before being overhauled.

Another advantage to Vapor Phase is that with jacket temperature maintained at 212° F. to 250° F., depending upon the installation, engines can operate on low grade fuels such as sour gas, sewer gas and Bunker C fuel.

WASTE HEAT RECOVERED BY VAPOR PHASE SYSTEMS CAN PERFORM MANY JOBS

Vapor Phase Cooling Systems recover the Jacket Heat and much of the Exhaust Heat which is normally wasted and convert it to useful purposes. **SPACE HEATING**—In the Aleutians, for example the United States Air Force uses waste heat recovered by Vapor Phase to heat the living quarters of the men in the Radar Stations. No other source of heat is necessary. **WATER DISTILLATION**—Aboard ship and in remote areas Vapor Phase Systems supply the heat necessary to distill potable water. **SLUDGE HEATING**—Sewage treatment plants use waste heat recovered by Vapor Phase to heat sludge before it enters the digester, thus eliminating a boiler and the fuel needed to heat it. **PETROLEUM PROCESSING**—Waste heat recovered by Vapor Phase is used in the petroleum industry to heat oil for some treating processes. **AIR CONDITIONING**—Vapor Phase recovered waste heat can operate the water chillers for an air conditioning installation.

HOW CAN VAPOR PHASE HELP YOU?

The uses to which Vapor Phase Cooling and Waste Heat Recovery Systems can be applied are increasing every day. Find out more about it; write for the full story on Vapor Phase economy in your operation.

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Bristol Expands Midwest Factory

The Midwest branch factory and offices of The Bristol Co. have moved from Chicago to enlarged



New Bristol Midwest factory office.

quarters at 2040 North Hawthorne Ave. in suburban Melrose Park, Ill. The new factory has been re-equipped with the latest equipment for assembling, testing, and calibrating various instruments manufactured by the company.

Warship Repowered

A former U. S. naval craft now a member of the Dominican Republic Navy, has been repowered with Enterprise diesel engines. The Dominican Republic's patrol vessel *P-105 Independencia*, had its engine room rejuvenated with the installation of two model DMG-36 Enterprise diesel engines. The engines are rated 932 hp at 500 rpm with heavy duty direct drive gears. Each engine turns a 60 in. diameter by 49 in. pitch three blade Columbian bronze propeller giving the patrol vessel a top speed of 19.5 knots which is an increase in speed of 4.5 knots over the former engines. Other engine room accessories supplied by Auto Marine Engineers of Miami, Florida were two General Motors



diesel generating units with 30 kw, 1200 rpm d c Delco generators and two Quincy air compressors. The *P-105*, formerly the *USS Icarus*, was built in 1931 and acquired by the Dominican government in 1949. It is 165 ft. long and has a beam of 25½ ft. The *P-105* is equipped with the most modern weapons and electronic instruments permitting its crew to operate in all types of weather. The overhaul and repowering was done at Ferreteria El Marino, C. por A, Ciudad Trujillo, D. N. under the direct supervision of Capt. Desiderio Sanchez Valera, M. de G., chief of Department of Construction and Naval Repairs.

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG**, Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs just \$10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG**, 9110 Sunset Blvd., Los Angeles 46, Calif.

DIESEL AND GAS ENGINE PROGRESS

Turbine Fuel Control

A turbine fuel control weighing only 1.875 lbs., complete with shutoff solenoid, has been added to the extensive family of similar controls built by The Garrett Corporation's AiResearch Manufacturing division, Phoenix, Arizona. Capacity of the unit's gear type pump is 200 lbs./hr. of JP-4 at 200 psig and 4,250 rpm. The control will also handle gasoline or diesel fuel. Fuel flow scheduling and limiting is pneumatically regulated from the compressor during acceleration. For a metered flow variation of 10 to 60 lbs./hr. a four percent speed drop is typical. Flowing JP-4 at 100 degrees F, allowable control input pressure range is -3 to +15 psig. The governor may be externally adjusted ± 20 per cent from standard rpm. **(ITS NEW)**

Lightweight Air-Cooled Diesels

A line of very light weight self contained air-cooled diesel engines in the 2 to 4½ bhp range is now available for powering portable equipment as well as emergency pumps and generators. The Yanmar is a 4 cycle, single cylinder engine operating the 2000 to 3000 rpm range. They may be obtained in two sizes with either crank shaft or half speed cam shaft drives. Similar small diesels are also available in water cooled models to 8 bhp at 2000 rpm. Imported from Japan, Yanmar diesels have been manufactured to U.S. standards for the American market. For further information write Continental Machinery Corp., P.O. Box 5309, Long Beach 5, Calif.



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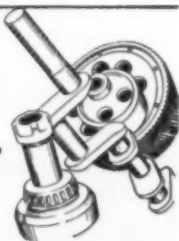
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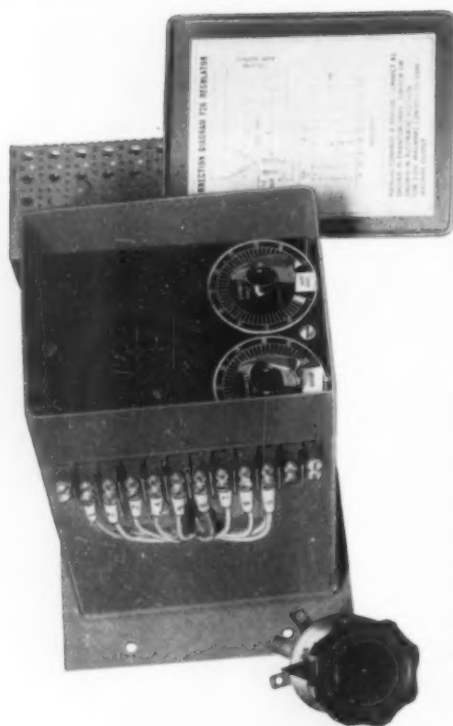
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 Voltage Regulator
 provides $\pm 1\%$ regulation
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Other Fincor Voltage Regulators are available for use with generators needing up to 5 kw field power

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F-26/60

4-53 Engine in 28-Footer

The number of pleasure boats with diesel engines continues to increase as engine manufacturers tailor engines in power, size and weight to fit all types and sizes of boats 22 ft. and up. Typical of the diesel trend in small boats was the recent delivery to the Detroit boating area of a 28-footer powered by a GM Diesel 4-53 engine. The craft is a shelter cabin sea-skiff model built by Henry Luhrs, boat builder on the Jersey coast. It was converted to diesel on its arrival to Lake St. Clair.



Owned by a Detroit boatsman, the craft will be used primarily in Lake St. Clair and neighboring waters. Under normal cruising conditions, it has a cruising range of about 150 mi. with fuel tankage for 50 gals. It sleeps two, and its home port will be the Grosse Pointe Yacht Club. The 4-53 Diesel, rated at 120 shp, turns a 16 in. x 12 in. wheel through direct drive to give the boat a speed of 20.5 mph.

Diesel Shipbuilding Delivers Nomad



The tug *Nomad* was recently launched at the yards of Diesel Shipbuilding Co. in Jacksonville, Fla. for service on the Intercoastal Waterways. This 57 ft., twin screw, tow vessel has a beam of 17 ft. 3 in. and a 7 ft. draft. Propulsion is provided by a pair of General Motors 6-110 diesel engines turning a pair of 50x40 in. four blade Ellis propellers through 4.5:1 Allison r&r gears. Specs called for hull, deck and bulkheads of $\frac{5}{16}$ in. steel plate, the deck house of $\frac{3}{16}$ in. steel plate and the pilot house of $\frac{3}{16}$ in. Alcoa Alloy #5154 aluminum. The *Nomad* has a fuel oil capacity of 5200 gals and her fresh water tanks hold 1000 gallons.

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DIESEL AND GAS ENGINE PROGRESS

Eastern Regional Manager



C. L. Hoebel

Charles L. Hoebel has been appointed Eastern Regional manager of Elliott Company, a division of Carrier Corp. Presently serving as New York district manager, a position he will continue to hold, Hoebel succeeds Mr. J. R. Lemmon, who will retire early in 1961. Starting with Elliott as a field engineer in 1952, he was appointed district manager of the New York territory in 1957. With Mr. Hoebel's appointment, the Eastern Regional office of Elliott will be moved from its present location in Philadelphia to New York.

Service Sales Manager



L. R. Wilson

Appointment of L. R. "Dick" Wilson as manager of manufacturers' service sales for Perfect Circle Corp. has been announced. Mr. Wilson succeeds Ralph Shelly, who had held the position since 1944. Having reached retirement age, Shelly has agreed to defer his actual retirement in order to serve Perfect Circle's International Division in a post similar to the one he has held for domestic sales. Mr. Shelly will maintain offices in Hagerstown though general offices of PC International are in Fort Wayne, Indiana.

AiResearch Contracts

Two contracts calling for delivery of 262 small gas turbine engines are among the latest received by The Garrett Corporation's AiResearch Manufacturing Division. Largest of the new orders, placed by the Department of the Navy, Bureau of Weapons, is for 232 gas turbines. These are to be delivered in several models and configurations, including one announced here for the first time. Twelve of these turbines will be delivered for mounting on a new, low silhouette tractor developed for the Navy. These diesel tractors stand only 34 in. from the deck. The new design offers greater safety and extreme under-wing maneuverability both for carrier use and ashore. Another



Navy's newest in both aircraft and ground support equipment is demonstrated at Glenview Naval Air Station, Illinois. Shown towing an A3J Vigilante is a versatile new low silhouette TD-80 Hough tractor mounting an AiResearch small gas turbine, marked by its exhaust port. Coiled electrical cord can be seen at back of tractor, pneumatic hose on top. Tractor stands only 34 in. high, including a 6 in. road clearance.

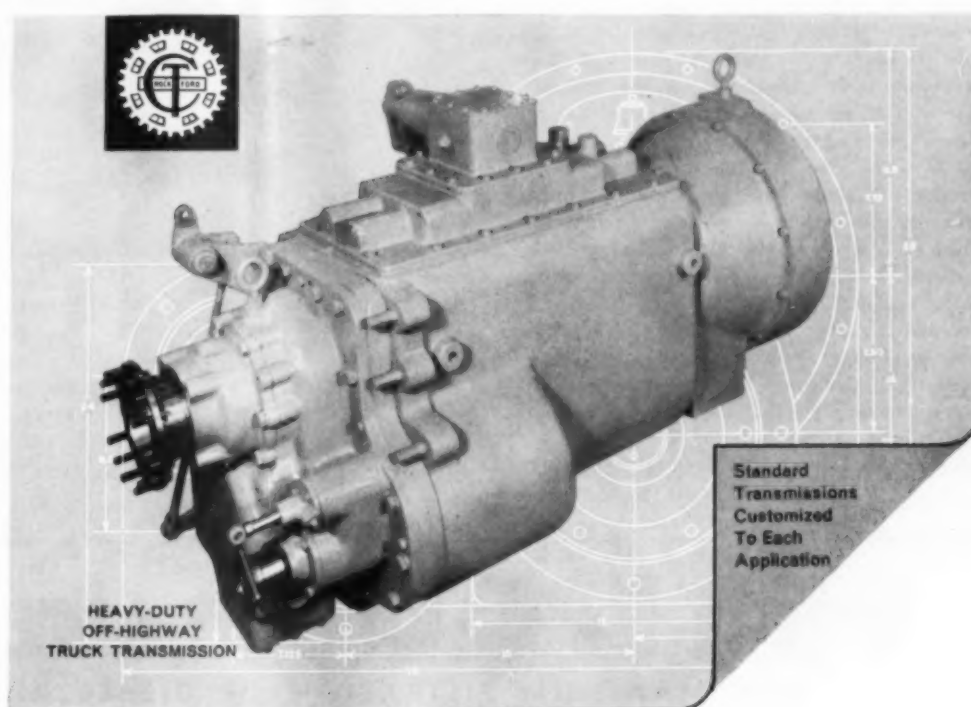
20 of the Navy turbines will be mounted on new AiResearch low silhouette trailers. These 34 in. high carts also house AiResearch model 105 turbines, and are designed as ground power for the Navy's newest jets, including the Vigilante and Phantom II. A second contract has been received from Convair Division of General Dynamics for 30 trailer-mounted compressors, also housing AiResearch 105 small gas turbines. These units will join previously shipped AiResearch turbines in providing ground support for the Convair-built Air Force B-58 Hustler. Largest turbines yet marketed by the firm which developed this type of equipment, the AiResearch 105 is capable of starting two B-58 engines simultaneously. The contracts total approximately \$10 million.

New Sales Manager



H. C. Foster

H. C. "Bud" Foster has been appointed general sales manager for both Gillett & Eaton and its subsidiary, Arrow Head Steel Products Co. of Howell, Mich. Company headquarters and main plant are at Lake City, Minn. Mr. Foster joined the piston manufacturing company in 1954 as a sales engineer covering the mid-central states. In February of this year he was appointed assistant sales manager.



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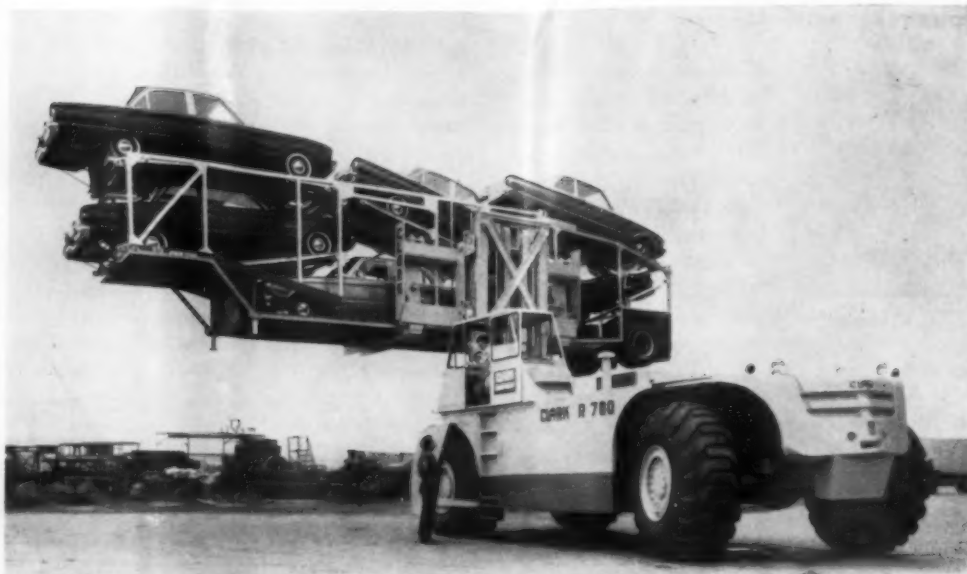
HEAVY-DUTY TRANSMISSIONS

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS



Huge General Purpose Fork Truck

A giant general purpose fork truck has been introduced by Clark Equipment Company's Industrial Truck Division. It will lift 35 tons. Named the Ranger 700, the truck is 12 ft. high over the cab, 29 ft. long (without forks), and 11 ft. wide. Its four tires are 74 inches high. A six-foot tall man can stand upright under the rear deck of the machine. With construction-type pneumatic tires and four wheel drive, the Ranger 700 is designed for especially heavy lifting work at steel yards, steel erection sites, lumber mills and similar outdoor operations. The fork truck is powered by a General Motors model 6057-C diesel engine, a six cylinder, two cycle unit with bore and stroke of $4\frac{1}{2} \times 5$ in. for 425.6 cu. in. displacement and rated 209 hp at 2200 rpm with fan and generator. The engine drives through a Clark industrial type, 3:1 multiplication factor torque converter and Clark full power shift, 4 speed full reversing transmission with center differential and manual lockout. The engine is equipped with a Donaldson oil bath intake air filter and AC lube and fuel oil filters. Because the massive loads the Ranger is capable of lifting often would obstruct the operator's forward view, the truck has two sets of operating controls. By swiveling in his bucket seat, the operator can use the rear controls to drive in reverse with comfort and complete visibility. The first five Ranger 700's have been purchased by Ford Motor Company's Steel Division, Dearborn, Mich., to handle steel slabs at temperatures up to 2000 degrees F. Power steering, power-shift transmission and four-wheel power-assisted hydraulic



Six Ford "Falccons" are less than half a load for 35 ton capacity Ranger 700 fork truck introduced by Clark Equipment Company's Industrial Truck Division. First five Rangers are going to Ford Motor Company's Steel Division to handle steel slabs at temperatures up to 2000 degrees F.

brakes are standard equipment. The forks, which weigh 3000 lbs. apiece, are moved together or apart hydraulically to fit different load widths. Forks also can be moved simultaneously left or right to pick up off-center loads. The five units going to Ford will tier to heights of 12 feet, but the Ranger can be equipped to stack higher, according to Clark. Lifting and tiering are accomplished through two $9\frac{1}{2}$ in. diameter lift cylinders and two

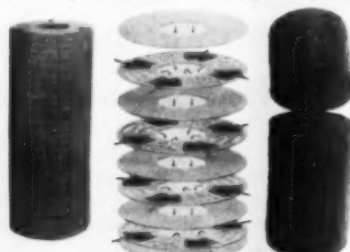
$9\frac{1}{2}$ in. tilt cylinders. The fork carriage is roller-mounted to the upright for friction-free operation. The hydraulic system contains four pumps—one each for the steering controls, the lift-tilt mechanism, the side-shifting device and the torque converter. Combined capacity of the pumps is 150 gpm. Further information on the Ranger 700 may be obtained by writing Industrial Truck Division, Clark Equipment Co., Battle Creek, Mich.

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Kocourek Promoted



R. S. Kocourek

Robert S. Kocourek has been promoted to the newly created position of Manager, manufacturing services, of Foote Bros. Gear and Machine Corp. Mr. Kocourek previously was factory manager, Plant No. 1, for Foote Bros. In his new post, he will coordinate manufacturing functions of all three Foote Bros. Chicago area plants. Herbert V. Cork has rejoined Foote to replace Kocourek as Factory Manager, Plant No. 1. For the past two years, he has been Planning Manager for Solo Cup Co., Chicago and before that was a project engineer for Foote Bros.

Sells 100th White Engine



Mr. Robert A. Zeidler (second from right), president of Arizona Engine & Pump Co., Phoenix, receives a handshake from William F. Burrows, vice president and general manager of the White Diesel Engine Division of The White Motor Co. in front of the 100th engine sold by Zeidler's firm. Waiting to add their congratulations are (from left) Joseph H. Newton, sales manager, and Martin H. Miller, assistant to the general manager, both of White Diesel. By coincidence, the "century mark" was reached on Zeidler's recent visit to the White plant in Springfield, Ohio. His firm is the Arizona distributor for White's natural gas engines. About one-third of these engines have been sold to Arizona Public Service Co. Coupled with large water pumps, the engines are used to irrigate arid ranch areas.



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Mid-West Diesel News

By L. H. Houck

THREE P&H 45 ton motor cranes with P&H diesel engines to Zachry-Brown, contractors, for use on Atlas missile site construction near Abilene, Tex.

INLAND GM Diesel, Inc., Milwaukee, installed a 4-71 GM diesel for sawmill operation for H. Hurlbert, Menomonie, Wis.

AN American 395 shovel owned by C. W. Purpero, Milwaukee, got a new GM diesel engine, a 4-71 from Inland GM Diesel.

KW-DART, Kansas City, has shipped a total of 60 model 25SL, 25 ton 320 hp dump trucks with Cummins diesels, to the Central Electrica de Furnas dam project on the Rio Grande river in Brazil's southern frontier country. Sale was through Cia. Importadora de Maquinas, KW-Dart's distributor in Rio de Janeiro, Brazil.

INLAND GM Diesel, Milwaukee, has delivered a new GM 8V-71, model 7082-7200 to Joseph Cayner, owner of a commercial fishing fleet at Port Washington, Wis., and the new unit is working in a fishing tug in Lake Michigan.

ROCK hauling on Atlas missile bases near Abilene, Tex., Zachry-Brown, general contractor, is done with a fleet of three 22 ton Euclids, with 6-71 GM

diesels, and three Koehring Dumpsters with GM diesels.

THREE International TD-9's with International diesels to Zachry-Brown, Abilene, Tex., for use in missile base construction. They are equipped with 4-in-1 Drott front ends.

DULIN Bauxite Co., Murfreesboro, Ark., is using an International TD-15 with 4-in-1 Drott for crusher loading. It was supplied by Little Rock Road Machinery Co., Little Rock.

NEW GM 4-53 diesel has been installed in a Ford T-700 dump truck owned by Edwin Siekierzynski, Hatley, Wis., by Inland GM Diesel, Inc., Milwaukee. A pilot job, it is giving a good account of itself hauling capacity loads of aggregate in the Stevens Point area.

TEXAS to West Coast pipeline job of the H. C. Price Co., features use of two LeRoi 1200 cfm rotary compressors with GM diesels, handling four drills each, drilling 4 blast holes at one time.

CRUSHING plants are going for the power of the new GM 12V-71 power units, according to Maynard W. Cole, president, Inland GM Diesel, Inc., Milwaukee with three of these big units being delivered recently to power Pioneer and CedaRapids crushing plants.

LETOURNEAU-Westinghouse B Tour-napull now has a GM 12V-71 diesel under the hood. New loading is 23 cu.

yds. struck, 29 yds. heaped, new 2-speed steer, up to 31.7 mph, making it one of the fastest and biggest scrapers, full 430 hp. Unit has a 10-speed transmission. A good number of sales to contractors with big dirt moving problems reported by Memphis dealer, Tri-State Equipment Co., Inc.

BAY Towing Co., New Orleans, is using a P&H 855 with P&H diesel to unload shell barges.

A GM 3-71 diesel to Vernon County Highway Committee, Wisconsin, from Inland, Milwaukee, for repowering an Austin-Western Model 88 grader.

Air, Hydraulic Cylinders

A new line of low cost air and low pressure hydraulic cylinders, from 1½ in. to 3½ in. bore, is announced by Mo-Bar Hydraulics Co. The new Mo-Bar "Cost Saver" cylinders are of simplified design. Air and hydraulic cylinders incorporate all the features of the present Mo-Bar line of air and hydraulic cylinders, including one-piece aluminum piston; hard chrome plated piston rod; aluminum end caps; seamless brass tube; block vee seals and wiper on rod and piston; and with adjustable cushions either end. Mo-Bar Bulletin No. 205 with detailed description, together with complete measurements for all bores, will be sent, on letterhead request, by writing Mo-Bar Hydraulics Co., Crystal Lake, Ill.

ITS NEW

Aircraft Starter Order

Contracts for small gas turbine engines, air turbine starters, and valves for C-130 aircraft on order by three governments have been received by The Garrett Corporation's AiResearch Manufacturing Division. Orders cover 48 gas turbines, 140 starters and a like number of pneumatic valves. All are for use aboard the Lockheed C-130 Hercules turboprop transport. The giant C-130s include 12 on order by the Indonesian government, and four ordered by Canada. Other aircraft included are for delivery to the U.S. Air Force, Navy and Coast Guard. AiResearch turbines on the Hercules are installed in the left wheel well. At the flip of a switch they drive generators to supply ground electricity, and also compressed air to AiResearch valves and starters. The starters, one on each of the four T-56 turboprop engines, convert this pneumatic energy to shaft power to boost engines to life.

New Service Manuals

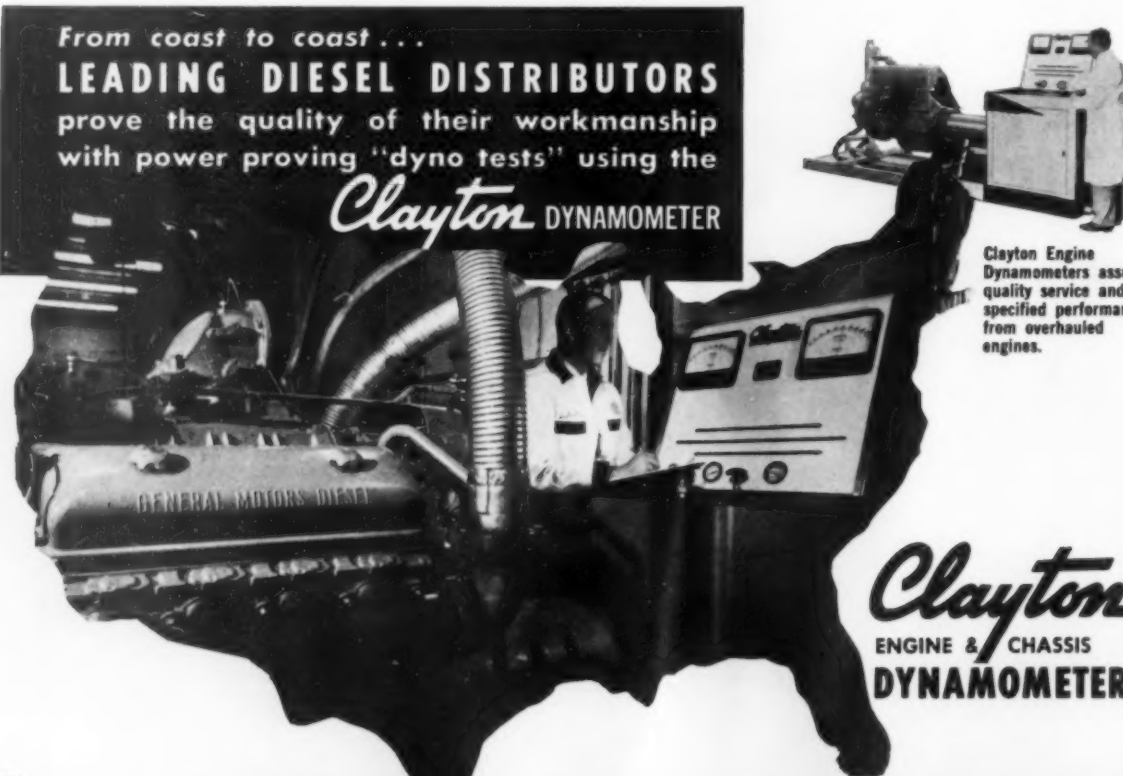
Fuller Manufacturing Co., has issued four manuals covering several of its transmissions. A 40-page service manual covers the specifications, lubrication, maintenance and repair of eight of its ten-speed transmissions. Models covered in the new manual are the Fuller 10-FA-65, 10-FA-650, 10-CA-65, 10-CA-650, 10-FB-65, 10-FB-650, 10-CB-65 and 10-CB-650 Transmissions. Fuller has combined step-by-step maintenance instructions with 115 photographs illustrating the steps taken in disassembly and assembly of the units. A 92 page service manual provides detailed information concerning the operation, lubrication, maintenance and repair of the nine-speed model R-1160 RoadRanger, which is designed primarily for heavy-duty off-highway and industrial applications. The manual contains 277 illustrations which show graphically the step-by-step operations involved in dismantling and assembling the R-1160. A 56 page service manual for the Fuller model 5-G-1520 describes operation, lubrication, maintenance and repair of the 5-speed transmission, which is designed for heavy-duty, off-highway equipment. Three diagrams and 163 photographs provide views of the components of the transmission and step-by-step aid to all maintenance and repair operations. A 28 page service manual gives the above information for Fuller model 5-A-65, 5-A-650, 5-C-65 and 5-C-650 transmissions. Owners of trucks or equipment which include any of these transmissions may obtain copies of this manual by requesting them from the dealer from whom the units were purchased, or by writing to Fuller Manufacturing Company, Transmission Division, Kalamazoo, Michigan.

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CLAYTON MANUFACTURING CO. 443 N. TEMPLE CITY BLVD., EL MONTE, CALIF. WRITE FOR CATALOG

Inland River Reports

By A. D. Burroughs

A Chattanooga (Tenn.) launching took place for *Midwestern*, newest towboat addition to Serodina, Inc. fleet. The push-power comes from two Caterpillar engines, rated at 397 hp each.

A Cummins engine supplies the 200 hp for the new *Beckie D.*, now in service for the Cave-In-Rock (Ill.) ferry service. The 40x12 ft. craft was delivered by Walker Boat Yard, Paducah, Ky.

CENTRAL Illinois Public Service accepted the seventh in the raised-pilot-house-vessel series from Humboldt Boat Service, St. Louis. The 50x18 ft. craft has 400 hp gained from two Caterpillar model D33 engines.

A new tug designed by St. Louis Shipbuilding & Steel Co. will soon be in action for Cairo Marine Service, Inc. The 55x22 ft. vessel is equipped with two Caterpillar D-375 engines supplying 650 hp.

CHRISTENING services put the *Pelican* in the midstream service for St. Louis Fuel and Supply Co. The 50x16 ft. craft, purchased from Universal Steel Supply Co., Crowley, La., has 330 hp from twin GM Detroit Model 671 engines.

A number of vessels have been recently

ordered, including two utility boats. To measure 45x15 ft., the 440 hp boats will go to Consorcio Puente Maracaibo from American Marine Corp., New Orleans.

DRAVO Corp., Pittsburg, has the order for two 6,000 hp towboats for Union Barge Line Corp. The 190 ft. vessels are expected to be completed in 1961, bringing the fleet towboat number to thirteen.

SIX tugs will be constructed by Gibbs Corp., Jacksonville, Fla., for the U.S. Coast Guard. Three of the 65x16 ft. tugs will go to Portsmouth, Va., three to New Orleans. Power will be supplied by a 400 hp Caterpillar engine.

PARKERSBURG, 53x17 ft. towboat built in 1956 at Barbour Metal Boat Works, is now using the 450 hp delivered from GM 6-110 engines for the Pittsburg trade for Capt. E. Harrison.

TWO 20-year-old engines have been removed from the *Stanolind A* by St. Louis Shipbuilding and Steel Co., and replaced with two 1600 hp GM Cleveland engines. The Standard Oil towboat has a power-boost from 1200 hp to 3200 hp.

FAIRBANKS-Morse power in performance on the lower Mississippi was observed when the *Laura Lee* was sighted. Rated conservatively at 4800 hp, the three-year-old 156 ft. towboat works for Upper Mississippi Towing Corp., Minn.

THE *Toltec* was another operator in the lower Mississippi proving the effectiveness of the 3975 hp supplied from three Enterprise engines. The 130 ft. towboat, completed in 1957 by Nashville Bridge Co., serves in the Indian River fleet.

THE *Philip Sporn*, one of the earliest popular 3200 hp towboats, was also spotted on the lower Mississippi. The towboat works for ACBL with power supplied from twin GM engines.

THE *Valley Voyager*, 200 ft. MVBL towboat was at work on the Ohio River with power from twin Nordberg Supair-thermal V-12 engines. Rivermen rate the power at 6000 hp for this 1957-production from Dravo yards.

THE *Eastern* was in action for UBL on the Ohio River with push-power from White Motor Co.'s Superior engines.

BOB BENTER, a popular Ohio River Co. towboat was busy on the Upper Ohio. Built in 1957 by St. Louis Shipbuilding and Steel Co., the 140x35 ft. towboat has 2160 hp provided from two Baldwin-Lima-Hamilton engines.

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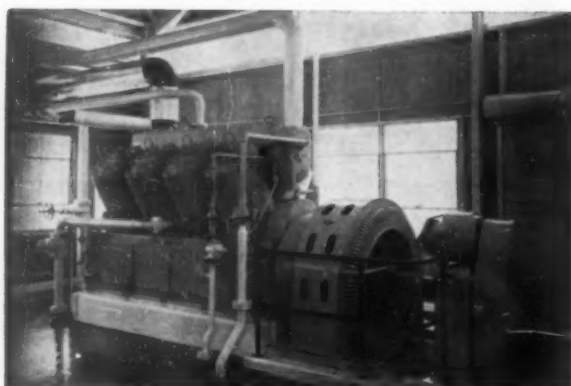
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A liquid level indicator that does not depend upon capacitance or capacitors has been developed by the Electronics Department of Hamilton Standard. It can be used to measure lubricants and other liquids on industrial engines and on a wide range of processing equipment. The elimination of capacitors, which possess limited tolerance for high temperatures and vibration, enables the indicator to operate reliably under severe conditions. Its main components, an electronic control and a unique sensing element which are combined as a single unit, can be engine-mounted and installed where heat and vibration prevent the use of conventional indicators. The sensing element of the unit will perform with a variety of liquids including those for which capacitive, photoelectric, and mechanical sensors are unsuitable. Response time is adjustable, and a special design feature prevents false readings in the event and sensing element is briefly uncovered. In normal operation, the indicator remains off until the liquid level drops to a predetermined point when it flashes or sounds a warning. The circuit can be checked at any time with a press-to-test button. For additional information, write Sales Manager, Electronics Department, D-40, Hamilton Standard, Broad Brook, Conn.

ITS NEW

Move Kansas City Office

Establishment of a new location for the Kansas City headquarters was announced recently by Nordberg Mfg. Co. The new offices are located at 5812 Roeland Drive, Mission, Kans. (Phone—Colfax 2-6110). J. T. Adams, Kansas City district manager for 12 years will continue in that capacity, assisted by J. A. Snarenberger, sales engineer, and G. Kreher and C. T. Pierce, service engineers.

Honeywell Research Head

Appointment of Dr. Van W. Bearinger as director of research for Minneapolis-Honeywell Regulator Co. and promotion of two other scientists to newly created positions of assistant research directors has been announced. Named assistant directors are Dr. John N. Dempsey and Edward E. Rexer. Dr. Bearinger has been associate research director since 1956. He fills a vacancy created about a year ago when Dr. Finn J. Larsen was elected a corporate vice president in charge of research. Dr. Bearinger will supervise the expanding activities of Honeywell's Research Center in Minneapolis, where nearly 200 scientists and specialists conduct work in all of the physical sciences. He is credited with sparking the development

of the nation's first power transistor and supervised Honeywell's development of power transistors. Dr. Dempsey joined Honeywell in 1952 after receiving a Ph.D. in physical chemistry from State University of Iowa. Mr. Rexer, also a physical chemist, has been a research section head since 1955.

20 New Whites

Twenty new White 9064TDL tractors were added to the Texas Consolidated Transportation Co. fleets at San Antonio, Corpus Christi, and Big Springs, Texas, it was announced by G. E. Daughett, president of the company, who reports TCTC is getting better than 6 mi. to the gallon with the new units in heavy duty gasoline hauls grossing out at 72,000 lbs. Fiberglass fenders and use of aluminum in engine, transmission, axle, frame fuel tank, oil filter, service brakes, and other components provides weight-saving in Texas Consolidated Transport's new White 9064-TDLs, Daughett said. The tractors are equipped with 220-hp diesel engine, SLHD tandem drive rear axle, 10.00x20 tires, and 10-speed RoadRanger transmission.

Joins International Division

Donald A. Harnsberger has joined the International Division of The Cooper-Bessemer Corp. as technical coordinator. Mr. Harnsberger will be responsible for liaison and coordination with the main office technical services required by Cooper-Bessemer's foreign subsidiaries and foreign licensees. He was formerly with Cooper-Bessemer from 1950 to 1953 as a field service engineer. He left C-B to enter the U.S. Army as an instructor in guided missile propulsion systems. After completing his tour of duty in the Army he held the position of senior nuclear engineer with the General Motors Corp. research staff until December 1958 when he became mechanical engineer with Pegasus Laboratories, Inc. He came to C-B from Pegasus.

C-B Sales Engineer

Appointment of Harvey B. Cox, Jr. as a sales engineer in the Cooper-Bessemer Corporation's Houston branch office, has been announced. Mr. Cox was formerly associated with the Clark Brothers Company in Houston, as a sales engineer.

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1-3 Cyl. F-M-210 HP-135.7 KW
1-2 Cyl. F-M-140 HP- 88.5 KW
1-6 Cyl. F-M-450 HP-300.0 KW

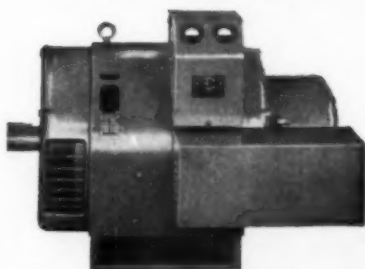
Call Mr. William Talbott
Superintendent of Utilities
Town of Williamsport, Indiana.

ESB Buys Edison Storage Battery Firm

The Edison storage battery business was recently purchased by The Electric Storage Battery Co. from the McGraw-Edison Company. Now known as the Nickel Alkaline Battery Division, the former Thomas A. Edison Industries storage battery unit of McGraw-Edison

If you hate maintenance, you'll like E-M's new BRUSHLESS BEMAC

"Packaged" Generator
(Brushless Excited Magnetic Amplifier Controlled)



BEMAC is available in ratings of 10 thru 150 kw, 3 phase; 10 thru 100 kw, 1 phase; 1200 and 1800 rpm; 0.8 PF; 60 cycles; broad-range voltages of: 120/208-139/240 and 240/416-277/480 volts, 3 phase; 120/240 volts, 1 phase.

NO COMMUTATOR! NO SLIP RINGS! NO BRUSHES!

Here is a generator that is *practically maintenance-free*. It requires no servicing other than an occasional bearing check. Efficient, reliable, ageless silicon diodes rectify the exciter a.c. to d.c., eliminating the need for commutators, brushes, and slip rings. There are many advantages:

Better suited to dusty, corrosive atmospheres. No electrical parts subject to wear and damage from dust and dirt.

Safer in hazardous atmospheres. No moving electrical contacts. Sparking is eliminated.

Easier to operate. No complicated adjustments—anyone can operate BEMAC.

Magnetic amplifier regulated. Voltage regulation is automatic. A unique static voltagesensing circuit gives $\pm 2\%$ regulation.

"Rock-Steady" voltage makes your motors, lights, and electronic equipment work better.

Starts big motors. Built-in voltage boost transformer makes big motor starting easier.

Simple to install. BEMAC is self-contained, completely factory assembled.

Publication 255 tells how BEMAC Generators work. Write for a free copy and call your E-M Field Engineer.



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MFG. COMPANY**
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continues to be headed by Robert A. Weeks, Jr., division manager, and by James A. Mustard, Jr., general sales manager. The new division reports to Monroe G. Smith, vice president of ESB. With manufacturing facilities at West Orange and the Silver Lake section of Bloomfield and Belleville, N.J., the division continues to manufacture the nickel-iron battery invented by Thomas A. Edison. It also will produce other alkaline types of industrial storage batteries. Nickel-iron batteries, having operating characteristics different from lead-acid batteries, have important applications in the industrial field.

Low Cost Oscillograph

Heiland Division of Minneapolis-Honeywell has introduced a low-cost direct-recording oscillograph designed for use in normal laboratory testing and evaluation. Known as the 1406 Visicorder, the new model produces instantly readable records of up to six channels of scientific and test data simultaneously, the company said. Users whose recording requirements lie in the middle frequency range can utilize the ultraviolet Visicorder recording technique without being forced to purchase unneeded and excess channel capacity and recording speeds. The model 1406 Visicorder may be ordered with a choice of galvanometers and record drive speeds, and is available with or without grid line and/or timing systems. It records variables from 0 to 200 cycles per second; has paper speeds of up to 25 in. per second and utilizes an internal three-speed timer capable of putting time lines on the paper at desired intervals. Further information on the new model 1406 Visicorder, including detailed price and delivery data, may be obtained by writing Minneapolis-Honeywell's Heiland Division, 5200 E. Evans Ave., Denver 22, Colo.

ITS NEW

Pipe Insulation Brochure

Owens-Corning Fiberglas has published a four-page brochure describing and illustrating its new product, Kaylo-Klad high temperature insulation for industrial piping in the power, chemical and refining industries. Copies of the brochure may be obtained, without charge, by writing Dept. 55-C, Sales Division, Owens-Corning Fiberglas, 717 Fifth Avenue, New York 22, N.Y.

ITS NEW

Parts Sales Assistant

C. L. McDougall has been appointed assistant parts sales manager of The Cooper-Bessemer Corp. Mr. McDougall joined Cooper-Bessemer as a sales engineer, and in 1950 was assigned to the Odessa, Texas branch of the company in that capacity. In 1957, he became branch manager at Odessa.

Onan Appoints Antz

D. W. Onan & Sons, Inc., Minneapolis, Minn., manufacturers of electric generating plants, recently announced appointment of Mathias M. Antz as zone manager for Florida, Georgia, Alabama and Tennessee. Mr. Antz is a graduate engineer of the University of Arizona and served in the Merchant Marine during W. W. II as an engineering officer. He was formerly with Merrill-Stevens Dry Dock Co., The Utica Div. of Curtiss Wright and more recently with American Marc Inc.

Special Techniques Booklet

Special techniques and processes available to help solve problems in production and development programs are described in a new booklet entitled "Got a Problem?" being released by Eaton Manufacturing Co.'s Valve Division. Cartoons illustrate many special techniques that the Valve Division employs in their

processes, which cover such things as forging, impact extrusions, heat treating, and special assemblies. The booklet is aimed specifically at helping readers with production problems, either through processes in existence at the Valve Division or with new processes which can be developed on the extensive R&D facilities at Battle Creek or in Eaton's Research Centers in Detroit and Cleveland. For further information, write Valve Division, Eaton Manufacturing Company, Battle Creek, Michigan.

ITS NEW

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG**, Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just \$10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG**, 9110 Sunset Blvd., Los Angeles 46, Calif.

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Frank J. Hunter (second from right), St. Louis Branch Sales Manager, The Cooper-Bessemer Corporation, discusses the engine-moving project with officials of St. Louis Shipbuilding & Steel Co.—(left to right) E. Enslin, V.P. and Works Manager; Roy Larson, Chief Mechanical Engineer; Paul Schiller, Naval Architect; Edward Renshaw, Chief Engineer; G. Riepl, General Superintendent.

World's most powerful towboat takes aboard its 9000 Cooper-Bessemer horsepower

Here you see plans being set for moving aboard of two of the four Cooper-Bessemer engines which will power the M/V America for Federal Barge Lines. This 9000 hp towboat... most powerful in the world... is nearing completion at St. Louis Shipbuilding & Steel Co., builders of the M/V United States and Austen S. Cargill (now under construction). These are the world's three most powerful towboats and they are powered by Cooper-Bessemer Engines. The four Cooper-Bessemer engines for the M/V America are turbocharged LS-8 diesels, rated at 2250 hp. They are equipped with Vapor Phase cooling systems, supplied by Engineering Controls, Inc., and they will burn low-cost residual fuel oil. The towboat is designed for 24-hour per day duty on the Mississippi.

For the latest in engine advancements, check with Cooper-Bessemer when you start to plan. Call the nearest office.

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